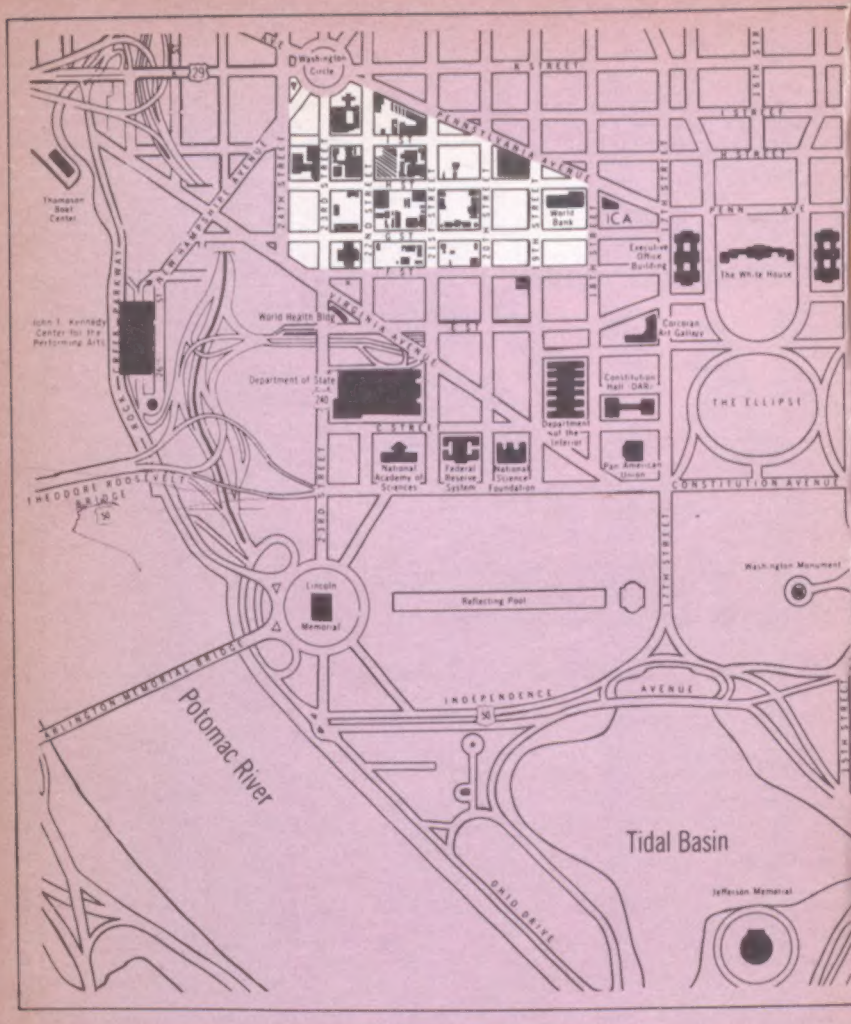
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E GEORGE WASHINGTON UNIVERSITY BULLETIN
ume LXXXI, Number 3, May 1982

DERGRADUATE AND GRADUATE PROGRAMS
2-1983



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THE GEORGE WASHINGTON UNIVERSITY BULLETIN

UNDERGRADUATE AND GRADUATE PROGRAMS
1982-1983

Columbian College of Arts and Sciences

Graduate School of Arts and Sciences

School of Education and Human Development

School of Government and Business Administration

School of Public and International Affairs

Division of Continuing Education and Summer Sessions

Division of Experimental Programs

For information concerning the School of Engineering and Applied Science, the National Law Center, or the School of Medicine and Health Sciences, please request the appropriate bulletin.

SPEC
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1982/83

UNIVERSITIES are undergoing change, either drastically o slowly, as they have been for centuries. Whatever the changes, th one premise on which universities are based remains constan universities are for learning—for acquiring learning, for transmittin learning, and for the exploration that yields new learning. Any othe objective is unworthy of a university, and any other purpose i incompatible with the best interests of students and their relation ship to the institution.

The faculty, through scholarship and research, extends learnin and it transmits learning by teaching. Students learn from th faculty, the library, and the laboratory—if they accept, as they mus learning as their objective. This learning does not take place in vacuum; in addition to the particular content of learning, studen will develop certain habits of mind—analytical thinking, powers insight, self-examination, and the use of rational discourse—th will serve them throughout their personal and professional lives.

Within this basic context, George Washington University invit students to take up their residence in order that their energies, i terests, and talents may be directed to learning.

Exceptional opportunities for learning are made possible becau of the University's location in the heart of the nation's capital. F example, cooperative programs are conducted in various fields study with members of Congress, the Smithsonian Institution, t Library of Congress, the National Gallery of Art, and other feder and private organizations. In addition to these programs, Washingt presents opportunities for observation, study, service, and recre tion limited only by students' time, energy, and imagination.

In this atmosphere, George Washington University seeks to pr vide a matrix for learning not available in the standard universi education, so that graduates can never forget that as students th were at the center of government and that they must forever car additional responsibility in and for society, because of the oppo tunity that was theirs.

The George Washington Universi
LLOYD H. ELLIOTT
President

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1982 **1983**

AUGUST

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1982 FALL SEMESTER

August 30 Orientation begins for students from foreign countries and for freshmen who did not attend Summer Advance Registration Program

August 31 Placement tests and advising for entering freshmen who did not attend Summer Advance Registration Program

Orientation begins for transfer students

September 1 Placement tests and advising for transfer students

Advising for sophomores, juniors, and seniors in the School of Government and Business Administration

†*September 1-3* Registration; application for February graduation due as part of registration

September 6 Labor Day (holiday)

September 7 On-campus classes begin

September 8 Off-campus classes begin
University Faculty Assembly meeting

* The Academic Calendar is subject to change.
† The registration procedure and the hours of registration will be stated in the *Schedule of Classes*, which is available well in advance of each semester.

September 17	Faculty Senate meeting
October 8	Faculty Senate meeting
October 13	Applications due for November Master's Comprehensive Examinations in the School of Public and International Affairs and in the School of Government and Business Administration
October 21	Board of Trustees meeting
November 1	Applications due for spring semester financial aid
November 12	Applications due for Ed.D., Ed.S., and M.A. in Ed.&H.D. Comprehensive Examinations Faculty Senate meeting
November 12-13	School of Public and International Affairs and School of Government and Business Administration Master's Comprehensive Examinations
November 22	D.B.A., D.P.A., Ed.D., and Ph.D. dissertations due from February candidates
November 24	Thanksgiving holiday begins after last class
November 29	Classes resume
December 7	Last day of fall semester on-campus classes
December 10	Faculty Senate meeting
December 11	Ed.D., Ed.S., and M.A. in Ed.&H.D. Comprehensive Examinations
December 13-22	Examination period
December 20	Last day of fall semester off-campus classes

1983 SPRING SEMESTER

January 7	Master's theses due from February candidates
January 10	Orientation for students from foreign countries
January 11-12	Orientation for new students; advising for all students
January 12	All degree requirements to be completed and reported to the Graduate School of Arts and Sciences for February graduation
**January 12-14*	Registration; application for May graduation due as part of registration
January 17	Spring semester on-campus and off-campus classes begin
January 20	Board of Trustees meeting
January 21	Faculty Senate meeting
January 25	University Faculty Assembly meeting
February 1	Deadline for submission of 1983-84 freshman student financial aid applications
February 11	Faculty Senate meeting
February 21	Winter Convocation (holiday)
March 1	Deadline for submission of 1983-84 undergraduate continuing and transfer student financial aid applications Ph.D. and Ed.D. dissertations due from May candidates

* The registration procedure and the hours of registration will be stated in the *Schedule of Classes*, which is available well in advance of each semester.

March 9	Applications due for April Master's Comprehensive Examinations in the School of Public and International Affairs and the School of Government and Business Administration
March 11	Faculty Senate meeting
March 12	Spring recess begins after last class
March 17	Board of Trustees meeting
March 18	Applications due for Ed.D., Ed.S., and M.A. in Ed.&H.D. Comprehensive Examinations
March 21	Classes resume
March 28	D.B.A. and D.P.A. dissertations due from May candidates
April 1	Deadline for submission of Summer Sessions and 1983-84 graduate financial aid applications
April 8	Faculty Senate meeting
April 15-16	School of Government and Business Administration and School of Public and International Affairs Master's Comprehensive Examinations
April 18	Master's theses due from all May candidates except those in the School of Public and International Affairs
April 21	All degree requirements to be completed and reported to the Graduate School of Arts and Sciences for May graduation
April 22	Last day of spring semester on-campus classes
	Master's theses due from May candidates in the School of Public and International Affairs
April 23	Ed.D., Ed.S., and M.A. in Ed.&H.D. Comprehensive Examinations
April 25	Last day of spring semester off-campus classes
April 28-May 7	Examination period
May 2	Last day for current master's degree candidates in the Graduate School of Arts and Sciences to apply for Ph.D. programs
May 6	Faculty Senate meeting
May 8	Commencement
May 19	Board of Trustees meeting

FACTS ABOUT GEORGE WASHINGTON UNIVERSITY

General Information	Private, nonsectarian, coeducational, founded 1821
Location	Washington, D.C., bounded by Pennsylvania Avenue and 19th, F, and 24th Streets, N.W.
Number of On-campus Students	8,995 full-time; 9,822 part-time
Geographical Origin of Students	50 states, District of Columbia, 120 countries
1982-83 Tuition	Undergraduate: $4,900 for two semesters; graduate: $180 for each semester hour (see pages 27-28)
Number of Full-time Faculty	1,102 (87% with doctoral degrees)
Number of Part-time Faculty	530 (includes some of the most distinguished men and women in Washington)
Room and Board	Cost varies from approximately $3,1 to $3,660 for the academic year (see pages 58-59)

Undergraduate majors: Accounting, American Civilization, American Literature, Anthropology, Applied Mathematics, Applied Statistics, Art History, Biology, Botany, Business Administration, Cartography, Chemistry, Chinese Language and Literature, Civil Engineering, Classical Archaeology and Anthropology, Classical Archaeology and Classics, Classical Humanities, Computer Science, Dramatic Art, Early Modern European Studies, East Asian Studies (China or Japan), Economics, Electrical Engineering, Elementary Education, English Literature, Environmental Studies, Fine Arts, French Language and Literature, Geodesy, Geography, Geology, Germanic Languages and Literatures, History, Human Kinetics and Leisure Studies, International Affairs, Journalism, Judaic Studies, Latin American Studies, Liberal Arts, Mathematical Statistics, Mathematics, Mechanical Engineering, Medical Technology, Middle Eastern Studies, Middle School Education, Music, Nurse Practitioner, Nursing Anesthesia, Operations Research and Computational Science, Philosophy, Physician Assistant, Physics, Political Communications, Political Science, Psychology, Public Affairs, Radio-Television, Radiologic Sciences and Administration, Religion, Russian Language and Literature, Russian Literature and Culture—in Translation, Secondary Education, Sociology, Spanish American Literature, Spanish Language and Literature, Special Education, Speech Communication, Speech Pathology and Audiology, Statistics, Urban Affairs, Zoology.

Study leading to graduate or professional degrees is offered in the Graduate School of Arts and Sciences, the National Law Center, the School of Medicine and Health Sciences, the School of Engineering and Applied Science, the School of Education and Human Development, the School of Government and Business Administration, and the School of Public and International Affairs.

THE UNIVERSITY

HISTORY

The George Washington University had its beginning in 1821 as The Columbian College in the District of Columbia. The name of the institution was changed in 1873 to Columbian University and in 1904 to The George Washington University. The debt of the University to George Washington, whose name it bears, is an intangible one.

George Washington, as President and as private citizen, had urgently insisted upon the establishment of a national university in the federal city. There he hoped that, while being instructed in the arts and sciences, students from all parts of the country would acquire the habits of good citizenship, throwing off local prejudices and gaining at first hand a knowledge of the practice, as well as the theory, of republican government. To further the materialization of his hopes, Washington left a bequest of fifty shares of The Potomac Company, "towards the endowment of a University to be established within the limits of the District of Columbia, under the auspices of the General Government, if that government should incline to extend a fostering hand towards it." The Congress never extended a "fostering hand." The Potomac Company passed out of existence, and Washington's bequest became worthless.

Fully conscious of Washington's hopes, but motivated primarily by a great missionary urge and the need for a learned clergy, a group of dedicated ministers and laymen sponsored a movement for the establishment of a college in the District of Columbia. Inspired largely by the zeal and energy of the Reverend Luther Rice, they raised funds for the purchase of a site and petitioned Congress for a charter. After much delay and amendment, Congress granted a charter which was approved by President Monroe on February 9, 1821. To safeguard the College's nonsectarian character it provided "That persons of every religious denomination shall be capable of being elected Trustees; nor shall any person, either as President, Professor, Tutor or pupil, be refused admittance into said College, or denied any of the privileges, immunities, or advantages thereof, for or on account of his sentiments in matters of religion."

During the entire time when the institution was known as Columbian College, its activities were centered on College Hill, a tract of forty-six and a half acres between the present Fourteenth and Fifteenth Streets extending north from Florida Avenue to somewhat beyond Columbia Road. The Medical School was located downtown. For the better part of the Columbian University period, the buildings of the University were situated along H Street between Thirteenth and Fifteenth Streets.

During the last half-century the University's present plant has been developed in that section of the old First Ward familiarly known as "Foggy Bottom," between Nineteenth and Twenty-fourth Streets, south of Pennsylvania Avenue. The area has many reminders of historic interest to the University. President Monroe, who signed the Charter, lived at 2017 Eye Street. The first President of the Board of Trustees, the Reverend Obadiah B. Brown, was for fifty years the pastor of a church at Nineteenth and Eye Streets, and Washington selected Twenty-third and E Streets as the site of the National University he hoped to see established.

PURPOSE AND OBJECTIVES

The purpose of The George Washington University was to realize "the aspirations of Washington, Jefferson and Madison, for the erection of a university at the seat of the Federal Government." Over the years it has been the aim to develop the University ideal in the nation's capital with a view toward meeting the changing needs of society while continuing to pursue the traditional principles of learning and research.

The George Washington University now rededicates itself and all the resources at its command to the pursuit of knowledge and its dissemination.

To this end:

The University recognizes its special opportunities in and obligations to one of the principal capitals of the world. It is a primary objective of the University to utilize its historical, geographical, and functional relationship to the nation's capital and the Washington community in continuing the development of a great nationally and internationally oriented university.

The University recognizes the needs of our times and accepts the challenge to develop each student's potential abilities to the fullest extent.

The University is and should remain privately controlled, nonsectarian and coeducational.

Admission to the University is determined only in terms of the personal character and academic qualifications of the candidates.

A broadly based liberal education is fundamental to the total program of the University.

Expansion of graduate and professional studies and research and the utilization for this purpose of the excellent research facilities and materials available in the nation's capital are basic to the continuous development of the University's educational program.

The provision of superior instruction and facilities and the application of high standards of entrance qualifications and academic achievement to all students whether full-time or part-time, on-campus or off-campus, are major missions of the University.

A balanced program of student extracurricular activities is an integral part of the University program.

The University will continue to strive to meet the evident needs of an enlarged student body while governing the size of enrollment by its capacity to supply adequate staff and facilities for the excellent teaching and research which it espouses.

THE COLLEGES, SCHOOLS, AND DIVISIONS

George Washington University includes 10 colleges, schools, and divisions as follows:

*Columbian College of Arts and Sciences** offers four-year programs in the arts and sciences leading to the degrees of Bachelor of Arts, Bachelor of Science, and Bachelor of Music. The College also provides prelegal and premedical programs, and the preprofessional work required for admission

* Columbian College of Arts and Sciences cooperates with the School of Medicine and Health Sciences in offering a program leading to the combined degrees of Bachelor of Arts and Doctor of Medicine.

o the School of Public and International Affairs. Columbian College has ıcademic jurisdiction over the off-campus programs leading to the degrees of Associate in Arts in General Studies, Bachelor of General Studies, Bachelor of Science in Geodesy, and Bachelor of Science in Cartographic Science. These off-campus programs are administered by the Division of Continuing Education and Summer Sessions.

The Graduate School of Arts and Sciences†* offers advanced study and research leading to the degrees of Master of Arts, Masters of Arts in Special Studies, Master of Fine Arts, Master of Forensic Sciences, Master of Music, Master of Science, Master of Science in Forensic Science, Master of Science in Special Studies, Master of Science for Teachers, and Doctor of Philosophy. The degrees of Master of Arts in Special Studies and Master of Science in Special Studies are also available through off-campus programs.

*The School of Medicine and Health Sciences** offers work leading to the degrees of Associate in Science, Bachelor of Science, and Doctor of Medicine.

The National Law Center† offers courses leading to the degrees of Juris Doctor, Master of Laws, Master of Comparative Law, Master of Comparative Law (American Practice), and Doctor of Juridical Science; and special programs in Continuing Legal Education.

The School of Engineering and Applied Science offers courses leading to the degree of Bachelor of Science in the following areas: civil engineering, electrical engineering, mechanical engineering, and operations research and computational science. Graduate programs lead to the degrees of Master of Science, Master of Engineering Administration, Engineer, Applied Scientist, and Doctor of Science. The School has academic jurisdiction over the off-campus programs leading to the degrees of Master of Science, Master of Engineering Administration, and Doctor of Science. These off-campus programs are administered by the Division of Continuing Education and Summer Sessions.

The School of Education and Human Development offers undergraduate programs leading to the degrees of Bachelor of Arts in Education and Human Development and Bachelor of Science in Human Kinetics and Leisure Studies; graduate studies leading to the degrees of Master of Arts in Education and Human Development, Master of Arts in Teaching, Education Specialist, and Doctor of Education. The degree of Master of Arts in Education and Human Development is also available through off-campus programs.

The School of Government and Business Administration† offers an undergraduate program leading to the degree of Bachelor of Business Administration and graduate programs leading to the degrees of Master of Accounting, Master of Business Administration, Master of Health Services Administration, Master of Public Administration, Master of Science in Information Systems Technology, Master of Urban and Regional Planning,

*The Graduate School of Arts and Sciences cooperates with the School of Medicine and Health Sciences in offering a program leading to the combined degrees of Master of Science and Doctor of Medicine and a dual program leading to the degrees of Doctor of Medicine and Doctor of Philosophy.

†The National Law Center cooperates with the School of Public and International Affairs, the Graduate School of Arts and Sciences, and the School of Government and Business Administration in offering programs leading to combined Juris Doctor and Master's degrees.

Post-Master's Graduate Certificate in Health Services Administrati Doctor of Business Administration, and Doctor of Public Administration.

*The School of Public and International Affairs** offers undergradua programs leading to the degree of Bachelor of Arts and graduate progra leading to the degree of Master of Arts.

The Division of Continuing Education and Summer Sessions assi in providing continuing education programs for adult students by a ministering or coordinating the off-campus credit offerings of the colleg and schools of the University, at both the undergraduate and gradu levels. Noncredit courses are also offered through the Division.

The Division of Experimental Programs supports University-wide cu ricular experimentation and development, especially the development new courses and new programs that entail interdisciplinary or int school cooperation or that utilize educational resources in the Washingt community.

ACADEMIC STATUS

George Washington University is accredited by its regional accreditin agency, the Middle States Association of Colleges and Secondary Schoo

The University is on the approved list of the American Association University Women and is a member of the College Entrance Examinati Board.

The National Law Center is a charter member of the Association American Law Schools and is approved by the Section of Legal Educ tion and Admissions to the Bar of the American Bar Association. T School of Medicine and Health Sciences is a member of the Associati of American Medical Colleges and is one of the medical colleges whi have been continuously approved by the American Medical Associati Undergraduate curricula of the School of Engineering and Applied Scien in civil, electrical, and mechanical engineering are accredited by t Engineers' Council for Professional Development. The School of Educati and Human Development is a charter member of the American Associati of Colleges for Teacher Education and is accredited by the Natio Council for Accreditation of Teacher Education for its bachelor's a master's degree programs. The School of Government and Business A ministration has maintained full membership in the Middle Atlantic A sociation of Colleges of Business Administration since 1961. It join the Council on Graduate Education for Public Administration in 19 In 1968, the School became a member of the American Assembly Collegiate Schools of Business and, in 1977, its undergraduate progr was accredited by the Assembly. The programs in accounting satis the educational requirements for the Certified Public Accountant a the Certified Management Accountant professional examinations. T program in health services administration is accredited by the Accred ing Commission on Education for Health Services Administration. T Master of Public Administration program is on the approved list of t National Association of Schools of Public Affairs and Administration. T

* The National Law Center cooperates with the School of Public and International Affairs, Graduate School of Arts and Sciences, and the School of Government and Business Administration in offering programs leading to combined Juris Doctor and Master's degrees.

Master of Urban and Regional Planning degree program is recognized by the American Planners Association. The Department of Chemistry is on the approved list of the American Chemical Society. The Department of Music is an accredited member of the National Association of Schools of Music. The graduate program in clinical psychology in the Department of Psychology is on the approved list of the American Psychological Association. The program in speech-language pathology and audiology is accredited by the Education and Training Board of the American Boards of Examiners in Speech Pathology and Audiology.

UNIVERSITY POLICY ON EQUAL OPPORTUNITY

George Washington University does not discriminate against any person on the basis of race, color, religion, sex, national origin, age, handicap, or veteran status. This policy covers all programs, services, policies, and procedures of the University, including admission to educational programs and employment. The University is subject to the District of Columbia Human Rights Law.

Inquiries concerning the application of this policy and federal laws and regulations concerning discrimination in education or employment programs and activities may be addressed to Dr. Marianne Phelps, Assistant Provost for Affirmative Action, George Washington University, Rice Hall, Washington, D.C. 20052, or to the Assistant Secretary for Civil Rights of the Department of Education.

LOCATION

The University is in downtown Washington, between Pennsylvania Avenue and 19th, F, and 24th Streets, N.W. In immediately adjacent areas are the White House, the World Bank, the Corcoran Gallery of Art, the Department of State, the National Academy of Sciences, the John F. Kennedy Center for the Performing Arts, and many other governmental and cultural institutions.

THE UNIVERSITY LIBRARIES

The library collections of the University are housed in the Melvin Gelman Library (the general library of the University) and in the libraries of the Institute for Sino-Soviet Studies, the National Law Center, and the School of Medicine and Health Sciences.

These collections contain approximately 1,200,000 volumes, to which are added some 50,000 volumes a year. Endowments supplementing the University appropriation provide books in the fields of American civilization, American literature, foreign service, history, public finance, and the social sciences; and gifts from many sources have enriched the collections. The libraries currently receive about 13,000 serials.

Information concerning the use of the libraries may be obtained at the library service desks.

The library is administered for the curricular, research, and recreational needs and interests of the students. Instruction in the use of the library is given by the reference librarians. The library endeavors to

assist students and all members of the University to use the rich libra resources of Washington and the unusual opportunities they offer f extensive research. Interlibrary loan arrangements are maintained wi other libraries in the city and throughout the United States.

The student has access to the Library of Congress, the Public Libra of the District of Columbia and its branches, and many of the spec collections of the government departments. Graduate students at Geor Washington University may, upon application, be issued a Consortiu library card which permits direct borrowing from the libraries of t other Consortium institutions.

THE BOARD OF TRUSTEES OF THE UNIVERSITY

The University is privately endowed and is governed by a Board Trustees of which the President of the University is an *ex officio* membe

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Henry Malcolm Steiner
Theodore George Toridis
Ruth Ann Wallace
Elyce Zenoff
John Edmund Ziolkowski

Mary M. Cheh, *Parliamentarian*

ADMISSIONS

The University accepts both men and women. Students are admitted at the beginning of each semester and summer session.

An application for admission to degree candidacy should be accompanied by a $20 (for undergraduate study) or $25 (for graduate study) application fee.‡ The application fee is waived for graduates of this University applying to the Graduate School of Arts and Sciences and for students applying for readmission who were registered as degree candidates at the time of their last registration at this University and who have not since registered at another institution.

Applicants are urged to submit the application form and complete credentials well in advance of the semester for which they seek admission. Specific dates are given in each section below.

Acceptance is based on space available and a prediction of potential for successful study. The following criteria are considered: degree or major objective related to rigor of program and grades achieved in secondary school or college, standardized test scores, relationship between grades and test scores, and recommendations.

The right is reserved to refuse admission to any student with an academic record which creates doubt of ability to succeed in college or who,

* Ex officio member
† Chairman of the Executive Committee
‡ Application fee must be by check or postal money order, payable to George Washington University.

for any other reason, would not be an acceptable student. In the selecti process, there is no discrimination because of sex, race, religion, handic national origin, or age.

UNDERGRADUATE ADMISSION*

Forms for application for admission or readmission to undergraduate nondegree status are available at and should be returned to the Office Admissions, George Washington University, Washington, D.C. 20052.

Secondary School Students

Applicants who wish to begin college in the fall semester or in a summ session should apply during the fall term of the senior year in high scho Preference will be given to students who submit applications and requir credentials prior to March 1. Students graduating at mid-year who wi to begin college in the spring semester should apply no later than N vember 1.

Early Notification—Although decisions on most applications for the f semester will require submission of seventh-term grades and senior-ye test scores, an earlier decision will be given after October 1 to studen whose applications become complete with secondary school recor through the junior year and junior-year test scores, provided these recor clearly establish admissibility.

Early Admission Plan—Unusually well-prepared students who ha completed the junior year in high school may be considered for admi sion. This plan is designed for those students who, in terms of academ preparation and emotional maturity, are ready to enter college. Mo often than not, students interested in early admission have substantiall exhausted the high school offerings in several academic areas. For su students, remaining in high school for the senior year would not be their best interest, nor in the best interest of the school.

To be considered for early admission, students must:

1. meet most of the secondary school requirements for graduation a complete the University's required entrance units (see page 66),
2. have the unqualified recommendation of the secondary school prin pal or counselor,
3. submit two letters of recommendation (in addition to the counselor' from teachers who can testify to the student's maturity and general rea ness to enter college,
4. submit SAT or ACT scores.

The student's chances for admission will be improved if scores of CEE achievement tests or Advanced Placement Tests in subjects taken in t sophomore year are submitted.

Applicants from a secondary school must arrange to have sent direct from their schools to the Office of Admissions a complete academic reco together with a personal evaluation and recommendation from the prin pal. This information should be supplied on a standard form used by t secondary school.

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* For detailed admission requirements, see the appropriate college or school in this *Bulleti* See pages 25-26 for admission requirements for students from foreign institutions.

ransfer Students

ndergraduate transfer students from other institutions should submit ap-
ication and required credentials prior to June 1 for the fall semester,
ovember 1 for the spring semester, and April 1 for the summer sessions.
The transfer student must be in good standing as to scholarship and
nduct. A student who has been academically dismissed or suspended
ore than one time normally will not be considered for admission.
An applicant who has attended one or more institutions of higher learn-
g must request each registrar to mail directly to the Office of Admissions
transcript of his or her record, even though credits were not earned.
If an applicant has fewer than 30 semester hours of acceptable work (C
better in academic courses from an accredited institution) at the time
e application is submitted, the applicant must request that his or her
gh school record and College Entrance Examination Board or ACT test
ores be sent to the Office of Admissions.

dvanced Tuition Deposit

fter notification of acceptance, a $100 advanced tuition deposit will be
equired of all full-time undergraduate students including those readmitted.
his deposit is not due until May 1 for students entering in the fall se-
ester or until December 15 for students entering in the spring semester.
he deposit is credited toward tuition and is not refundable.

dvanced Standing and Advanced Placement

REDIT FROM INSTITUTIONS OF HIGHER LEARNING

Where there is no duplication involved either through course work or
xamination, credit may be granted for work successfully completed at
ccredited institutions of higher learning. Although transfer credit may be
ssigned, it must meet requirements for the degree sought in order to be
ounted towards that degree. Credit may be accepted provisionally. Work
f low-pass grade (*D* or the equivalent) will not be considered for transfer.
Except for students transferring to the School of Government and Busi-
ess Administration or to Columbian College of Arts and Sciences from
wo-year colleges, in which case no more than 60 or 66 semester hours of
redit may be assigned, respectively, there is no strict limit to the total
mount of credit that may be assigned. However, a student must satisfy the
esidence and course requirements for the degree sought at George Wash-
ngton University.

REDIT BY EXAMINATION

Assuming there is no duplication of course work, a maximum of 30
emester hours of credit may be assigned upon admission to the University
or each or any combination of the following except as noted:

OLLEGE ENTRANCE EXAMINATION BOARD
DVANCED PLACEMENT TESTS (APT)

Credit is assigned for examinations passed with scores of four or five on
he basis of a score report sent to the Office of Admissions from the Edu-
ational Testing Service at the student's request. Examinations passed
with scores of three will be considered for credit or placement if the

student arranges to have the examination paper sent to the Office of A missions. The Advanced Placement Tests are administered in the sec dary schools in May of each year. Normally only students who complet course designated as Advanced Placement are prepared for the exami tion. Arrangements for the examination are the responsibility of applicant and should be made through the secondary school attended with the Program Director, College Entrance Examination Board, Advan Placement Tests, Box 592, Princeton, N.J. 08540, or Box 1025, Berkel Calif. 94701.

COLLEGE ENTRANCE EXAMINATION BOARD COLLEGE-LEVEL EXAMINATION PROGRAM (CLEP)

CLEP offers two types of examinations: General and Subject Exami tions. CLEP General Examinations are offered in five areas: mathemati social sciences, humanities, natural sciences, and English compositi CLEP Subject Examinations measure achievement in specific college-le courses and are offered in more than 20 subjects.

Upon admission to a program leading toward a degree, credit assigned for the General Examinations, with the exception of the Engl composition examination and the mathematics examination.* To rece credit, examinations must be passed at the 50th percentile or abo (1963/1972 college sophomore norms). Credit is assigned, with a f exceptions, for the Subject Examinations passed at the level recommend in the College Board model policy.* A candidate for a degree who registered at this University must seek departmental and dean's appro *prior* to taking the examination to receive credit for a CLEP Subj Examination. Credit may not be earned by passing the examination af having taken the equivalent course. Arrangements for the examinatio are the responsibility of the applicant and should be made with College Entrance Examination Board College-Level Examination P gram, Box 1824, Princeton, N.J. 08540.

SPECIAL DEPARTMENTAL EXAMINATIONS FOR UNDERGRADUATES

Except for students admitted to the School of Government and Busin Administration, credit may be assigned for Special Departmental Exa nations; see page 75.

CREDIT EARNED THROUGH UNITED STATES ARMED FORCES INSTITUTE (USA

Except for students enrolled in the School of Government and Busin Administration, credit is assigned for approved United States Arm Forces Institute college-level examinations passed with satisfactory scor

CREDIT FROM SERVICE SCHOOLS

Except for undergraduates admitted to the School of Government a Business Administration, a limited amount of credit may be assigned f selected service school instruction received since 1941. Veterans sho submit to the Office of Admissions photostatic copies of their serv school records, indicating courses successfully completed with sufficie

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* See page 139 for additional qualifications for applicants to the School of Government Business Administration.

ntification of the course to locate it in the *Guide to Evaluation of Edu-ional Experience in the Armed Forces.*

EDIT FOR COURSES OFFERED BY NONCOLLEGIATE ORGANIZATIONS

cept for undergraduates admitted to the School of Government and siness Administration, a limited amount of credit may be assigned for ected courses offered by noncollegiate organizations. The University igns some of the credit listed in the *National Guide to Credit Rec-mended for Noncollegiate Courses.* Students who wish to know if urses offered by their employers can be considered for credit should quire at the Office of Admissions. Courses containing fewer than 30 urs of class instruction are not reviewed. Records, which vary with sponsoring organization, will be required.

EDIT FOR COURSES OFFERED THROUGH CORRESPONDENCE AND TELEVISION

cept for undergraduates admitted to the School of Government and siness Administration, a limited amount of credit may be assigned for ected courses offered by non-traditional methods, provided that such urses require the student's physical presence in a monitored final exami-tion. Assignment of such credit will require a statement from the institu-n concerned that such an examination was a required part of the course.

VANCED PLACEMENT

lvanced placement or waiver of a requirement will be granted on the sis of scores on Achievement Tests of the College Entrance Examina-n Board as follows:

Achievement Test	Minimum Score	Exemption
glish Composition	650	Waives Engl 10
ropean and/or American History	600	Waives Hist 39-40 and/or 71-72
ench	650	Waives a two-year language requirement
rman	600	
brew	600	
tin	600	
ssian	700	
anish	650	

score of 58 or above on the Test of Standard Written English will waive glish 10.

RADUATE ADMISSION*

Graduate School of Arts and Sciences—Forms for application for ad-ission or readmission are available at the Office of the Dean of the raduate School of Arts and Sciences, George Washington University, ashington, D.C. 20052. Completed applications and requests for fellow-ip support must be submitted by February 15 (February 1 for students clinical psychology and art therapy) for admission in the fall semester d by November 1 for the spring semester. Applications for graduate

*For detailed admission requirements, see the appropriate college or school in this *Bulletin*. e pages 25-26 for admission requirements for students from foreign institutions.

study are acceptable after these dates for admission in the correspond semester and will be reviewed if time permits and if space is availabl the program desired.

School of Education and Human Development—Forms for applica for admission or readmission are available at the Office of the Dean of School of Education and Human Development, George Washington U versity, Washington, D.C. 20052. When completed, these application fo should be submitted to this Office no later than June 1 for the fall semes November 1 for the spring semester and April 1 for the summer sessi unless an extension is granted by the office of the dean.

School of Government and Business Administration—Forms for ap cation for admission or readmission are available at the Graduate Adm sion Office, School of Government and Business Administration, Geo Washington University, Washington, D.C. 20052. The Application Graduate Degree Candidacy shows the application deadlines for the grees offered by this school.

School of Public and International Affairs—Forms for application admission or readmission are available at the Graduate Admissions Offi School of Public and International Affairs, George Washington Univers Washington, D.C. 20052. When completed, these application forms sho be submitted to this Office no later than March 1 (February 1 for app cants for graduate fellowships or assistantships and foreign applican Admission is for the fall semester only. All credentials, including tr scripts from all institutions attended, Graduate Record Examination sco and letters of reference, must be received before the deadline date.

DIVISION OF CONTINUING EDUCATION AND SUMMER SESSIO

Forms for application for admission to *nondegree* status in the Division Continuing Education and Summer Sessions are available at and should returned to the Office of Admissions, George Washington Universi Washington, D.C. 20052. When completed, these application forms, w credentials when required, should be received by the Office of Admissi no later than the Friday before the first day of registration (see Calend pages 5-7). To avoid paying a late registration fee, every effort should made to insure that any required credential is in the Office of Admissi prior to registration. No fee is charged for application for admission this Division. For detailed entrance requirements, see page 181.

Registration in a given course may be denied students in this Divisi when space is needed for degree candidates. Unless working toward degree elsewhere, students in this Division may not take accounting, bu ness administration, or management science courses.

READMISSION

Students previously registered in the University who were not register on campus during the immediately preceding semester (summer sessi excluded), must apply for readmission. Final dates for applying are t same as those for "Undergraduate Admission" (see pages 20-21), "Graduate Admission" (see pages 23-24). Students who apply as degr candidates and who were previously registered as nondegree students,

o attended one or more institutions of higher learning during absence
n the University, must have complete official transcripts sent to the ap-
priate office at this University from each institution attended. Applica-
ns for readmission are considered on the basis of regulations in effect at
time of readmission.
he application fee is waived for students applying for readmission who
e registered as degree candidates at the time of last registration at this
versity and who have not since registered at another institution.

UDENTS FROM FOREIGN INSTITUTIONS*

plication, required records, and scores on the *Test of English as a*
eign Language (see below) should be received from international
dents no later than March 1 (February 1 for applicants for graduate
dy in the School of Public and International Affairs) for the fall se-
ster and October 1 for the spring semester.
George Washington University offers an English-language program for
eign students.

quired Records

the time the application is sent, students must request the educational
titution previously attended to send directly to the appropriate ad-
ssions office (see "Undergraduate Admission," pages 20-21, or "Graduate
mission," pages 23-24) copies of official certificates and records listing
bjects studied, grades received, examinations taken and degrees re-
ved. Certified copies of diplomas and certificates from all secondary
hools, colleges, and universities attended are required. Records of
te examinations and certificates are also required. These records be-
me the property of the University and cannot be returned.
These documents should be in the language in which the institution
eps its official records. If they are in a language other than English,
e copies which are sent should be accompanied by an English translation.

nguage Tests

udents whose native tongue is not English should take the *Test of*
glish as a Foreign Language (TOEFL) and have the scores submitted
the appropriate admissions office. Those students seeking admission
the School of Government and Business Administration and to the
gree programs in cartography and geodesy must submit a TOEFL score.
udents are responsible for making arrangements for taking the test
addressing inquiries to TOEFL, Educational Testing Service, Prince-
n, N.J. 08540, U.S.A., well in advance of the beginning of the semester
r which admission is sought. The test fee remitted with the application
titles the student to have the test score sent to three different institutions.
egistration for the *Test of English as a Foreign Language* does not con-
itute application for admission to George Washington University.
The *Bulletin of Information*, obtainable without charge, contains a de-
ription of the test as well as rules regarding application, fees, reports,
d the conduct of the test; lists of examination centers; examination dates;
d an application blank. On the application for the test, the student

*For detailed admission requirements, see the appropriate college or school in this Bulletin.

should specify that the scores be sent to the appropriate admissions o at this University (see "Undergraduate Admission," pages 20-21 "Graduate Admission," pages 23-24).

An admitted student scoring less than 600 on the TOEFL is require take a test in English as a second language prior to registration. Result this test will determine the courses in which the student will be permi to register. If the knowledge of English is inadequate to enable the dent to undertake any academic work, the student will be required to s English on a full-time basis.

Financial Certificate

If a student plans to enter or remain in the United States to study at University and the visa status will be either student (F) or exch visitor (J), a Form I-20 or IAP-66 cannot be issued until the student been admitted to the University and has completed the Financial Ce cate to our satisfaction.

TRANSFER WITHIN THE UNIVERSITY

For information concerning transfer from one college, school, or divisio another within the University, see page 47.

REGISTRATION

The dates, hours, and place of registration will be stated in the *Sched of Classes*, which is available well in advance of each semester.

Registration in on-campus courses is open only to those persons form admitted to the University by the appropriate admitting office, as well those students in good standing who are continuing in an approved p gram of study.

No registration is accepted for less than a semester or one summer s sion.

Students may not register concurrently in this University and anot institution without the prior permission of the dean of the college, scho or division in which registered in this University. Registration in m than one college, school, or division of the University requires the writ permission of the deans concerned, *prior to registration*. Allowance credit for work done concurrently at another institution is at the discret of the appropriate committee.

Eligibility for Registration

Registration for the following categories of campus students is held on t days of registration stated in the University Calendar. A student who

pended or whose record is not clear for any reason is not eligible to ster. Registration in a given course may be denied students in the sion of University and Summer Students when space is needed for ree candidates.

lew Student—Upon receipt of a letter of admission, the new student is ible for registration on the stated days of registration.

leadmitted Student—A student previously registered in the University o was not registered on campus during the preceding semester or sum- session must apply for and receive a letter of readmission from the ropriate admitting office before he or she is eligible for registration.

Continuing Student—The student registered on campus in the immedi- ly preceding semester or the summer session preceding the fall semester eligible to register assuming good standing and enrollment in a con- uing program.

mpletion of Registration

istration is not complete until financial settlement is made. Attendance lass is not permitted until registration has been completed.

gistration Changes and Withdrawals (See page 47)

gistration for Consortium Courses

gree students interested in taking courses at any of the other in- tutions in the Consortium of Universities of the Washington Metropolitan ea, Inc. (see page 52), should consult the program announcements of other institutions. Consortium registration forms and instructions may picked up in the Office of the Registrar after obtaining registration terials. In order to participate in the Consortium program, students must tain the approval of an advisor and should ascertain from the depart- nt of the institution where the course is taught whether they are eligible r the course and whether there is space in the class. Specific inquiries ould be addressed to the Registrar.

EES AND FINANCIAL REGULATIONS

ees paid by students cover only a portion of the cost of the operation the University. Income from endowment funds, grants, and gifts from umni and friends of the institution makes up the difference.

The following fees and financial regulations were adopted for the 1982 mmer sessions and the academic year 1982-83.

uition Fees

or undergraduate study in Columbian College of Arts and Sciences, the School Education and Human Development, the School of Government and Business dministration, and the School of Public and International Affairs:

On-campus full-time program (12 or more semester hours), each semester $2,
On-campus part-time program, each semester hour .....
Off-campus part-time program, each semester hour .....
Summer Sessions, each semester hour .....

For graduate study* in the Graduate School of Arts and Sciences, the Sch
Education and Human Development, the School of Government and Bus
Administration,† and the School of Public and International Affairs, an
graduate and undergraduate courses taken by nondegree students:

On-campus, each semester hour .....
Off-campus, each semester hour .....
Summer Sessions, each semester hour .....

University Center Fee (charged all students registered on campus)

For students registered for 11 or more semester hours:
Each semester .....
For students registered for less than 11 semester hours:
Each semester hour .....

Additional Course Fees

In certain courses additional fees, such as laboratory and material fees
charged as indicated in the course descriptions. These fees are charged by
semester and, unless otherwise indicated, may be defrayed in two paym
when the tuition is paid in this manner. If breakage of apparatus is in ex
of the normal amount provided for in the laboratory fee, the individual stu
will be required to pay such additional charges as are determined by the
partment concerned.

Graduation Fees

Associate in Arts .....
All other degrees offered by the University .....
Fee for binding master's thesis .....
Fee for microfilm service and printing announcement of final examination (doctoral candidates) .....

Residence Hall Fees (see pages 58-59)

Special Fees and Deposits

Application fee (undergraduate degree candidate), nonrefundable ...
Application fee (graduate degree candidate), nonrefundable .....
Advanced tuition deposit, nonrefundable, charged each entering or readmitted full-time undergraduate student .....
Housing deposit, nonrefundable, charged each applicant for residence hall space .....
Admission tests (when required) 6.00–1
Late-registration fee, for failure to register within the designated period (charged on-campus students only) .....

* Payment of tuition for a master's thesis entitles the candidate, during the period of regi
tion, to the advice and direction of the member of the faculty under whom the thesis is t
written. In case a thesis is unfinished, additional semester hours may be required in accord
with the regulations of the school in which the student is registered.
† Students entering doctoral programs in the School of Government and Business Administra
in 1982-83 will be charged $13,200 for the entire degree program, to be paid in 10 semian
installments. Contact the School's Doctoral Programs Office.

-payment fee (see Payment of Fees, below)	15.00
campus financial reinstatement fee, for reinstatement after financial encumbrance for nonpayment of fees (see Payment of Fees, low)	35.00
campus financial reinstatement fee, for reinstatement after financial encumbrance for nonpayment of fees (see Payment of Fees, elow)	15.00
urned check fee, charged a student whose check is improperly rafted, incomplete, or returned by the bank for any reason	15.00
cial Columbian College of Arts and Sciences departmental examination to qualify for receiving credit (advanced standing), waiver f requirement, or both	25.00
iver examination to qualify for advanced placement	5.00
lish test for international students (when required)	10.00
oratory checkout fee, for failure to check out of chemistry laboratory by the deadline date set by the instructor*	10.00
rles E. Smith Center fee (for off-campus degree candidates only) tudents registered as degree candidates in a program offered hrough the Division of Continuing Education and Summer Sessions may purchase, on a semester-by-semester basis, a special ard entitling them to use the Smith Center facilities for that emester or session. Students must first obtain from the Division signed certificate attesting to degree candidacy	25.00
nscript fee	2.00
f two or more transcripts are requested at the same time, fee for ach of the first two copies is $2; fee for each additional copy	.50
placement of lost or stolen picture identification card	2.00

gistration for on-campus courses in the University entitles each student the following University privileges: (1) the services of the Student d Alumni Career Services Office; (2) the use of the University Library; gymnasium privileges; (4) admission to all athletic contests, unless herwise specified; (5) subscription to the *University Hatchet*, the student wspaper; (6) admission to University debates; (7) medical attention as scribed under Student Health Service. These privileges terminate when e student withdraws or is dismissed from the University.

stdoctoral Study

hose who have graduated from George Washington University with a .D., Ed.D., D.Sc., D.B.A., or D.P.A. may continue any studies in the niversity without payment of tuition, and enjoy all University library ivileges. Such graduates are required to pay a nominal fee based the prevailing credit hour rate for one semester hour, as well as e University Center fee, in order to establish their active membership the University. The use of laboratory space and equipment is contingent upon availability, and the cost of all laboratory or special library aterial is paid by the graduate. Special arrangements for such privileges ust be made with the dean two months in advance of the semester which the graduate wishes to register. Postdoctoral work taken under is privilege may not be taken for credit.

*A student who drops a chemistry course before the end of the semester must check out of the boratory at the next laboratory period.

Payment of Fees

No student is permitted to complete registration or attend classes un charges are paid or until arrangements for payment have been Tuition and fees for each semester are due and payable in full Office of the Cashier at the time of each registration. Checks shou made payable to George Washington University, with the student i fication number in the upper left-hand corner.

The Student Accounts Office has responsibility for billing and mai ing student accounts for tuition, various fees, and room and board cha A student registered for six semester hours or more may sign a def payment contract with the Student Accounts Office at the time of registration permitting payment of one-half of the total tuition and (except for fees payable in advance) at the time of registration and remaining half on or before Wednesday of the eighth week of classe the fall and spring semesters. Interest at the rate of 8 per cent per an on the unpaid balance will be charged from the date of registration t date payment is made. A 10-month payment plan is also available.

Students receiving tuition assistance in the form of scholarships, gov ment tuition contracts, or other forms of tuition awards are not permi to sign deferred payment contracts unless the total tuition and fee cha exceed the value of the tuition awards by $800.00 or more. Under such cumstances the student may be permitted to pay one-half of the am due at the time of registration and to defer the balance by signi deferred payment contract.

Students who fail to make any payment when due will be automati charged a $15 late-payment fee and will be subject to the interest ch of 8 per cent per annum. Accounts which become 30 days past due wi financially encumbered. In the event a student's account is financ encumbered, the student forfeits rights to the use of deferred pay contracts in future semesters, and the Student Accounts Office will n the Registrar to withhold grades, future registration privileges, transcr diplomas and other academic information until the account is set financially. Financial settlement will require payment in full of all amo due to the University in addition to a financial reinstatement fee of $35 on-campus students and $15 for off-campus students.

Students auditing courses are subject to all fees charged to stud registered for credit.

Returned check—A student whose check is returned unpaid by the b for any reason will be charged a returned check fee. If the check is paid within 15 days, the student will forfeit all rights to check cashin the University, and future payments for tuition, dormitory, food serv and other special fees will require payment by cash, certified check, money order.

Off-Campus Courses

Fees for each semester are due and payable in full at the time of e registration; however, a student registering for a 13-week or longer cre course may sign a deferred payment contract at each registration to ma payments in three equal installments—one-third at the time of registrati one-third by October 4, and one-third by November 4 (for the fall sem

; one-third at the time of registration, one-third by February 8, and -third by March 8 (for the spring semester). Payments are due at the ulated times. Interest at the rate of 8 percent per annum on the unpaid ance will be charged from the beginning of each semester to the date ment is made.

tudents receiving partial government tuition assistance, employee bene-, and partial scholarships must pay their portion of the tuition in full he time of registration.

Except for specified special sessions, tuition and fees for credit courses ting less than 13 weeks, and for all noncredit courses, are payable in at registration.

paid and Deferred Payment Plans

veral commercial programs for parents who wish to pay for college on nonthly basis are available. Terms and conditions vary, but most provide fe insurance policy in the contract. For specific details and applications, dress inquiries to the following:

1. Girard Edu-Check Plan, 2nd and Chestnut Streets, Philadelphia, Pa. 19106
2. Richard C. Knight Insured Tuition Payment Plan, 6 St. James Avenue, Boston, Mass. 02100
3. The Tuition Plan, Inc., Concord, N.H. 03301

The University's Office of Student Financial Aid does not maintain a pply of applications for these various programs, but will be happy to ovide guidance to students and parents.

ithdrawals and Refunds*

pplications for withdrawal from the University or for change in class hedule must be made in person or in writing to the dean of the college, hool, or division in which the student is registered. Notification to an structor is not an acceptable notice (see "Withdrawal," page 47).

In authorized withdrawals and changes in schedule, cancellations of mester tuition charges and fees will be made in accordance with the llowing schedule for the fall and spring semesters:

Complete withdrawal from the University (on-campus students):

Withdrawal dated on or before Saturday of the first week of classes..	90%
Withdrawal dated on or before Saturday of the third week of classes.	75%
Withdrawal dated on or before Saturday of the fifth week of classes..	50%
Withdrawal dated after the fifth week of classes	None

For a change in status from full-time to part-time student or for partial withdrawal by a part-time student, the above schedule applies to the difference between charges for the original program and the adjusted charges for the revised program.

A student enrolled in an undergraduate full-time program who drops or adds a course and continues to be in a full-time program will have no financial adjustments of tuition made other than those involving course fees.

Regulations concerning withdrawal and refunds for the summer sessions are stated in the ummer Sessions Schedule of Classes.

4. Regulations governing student withdrawals as they relate to resid hall and food service charges are contained in the specific lease arr ments.
5. *Refund Schedule for Off-Campus Registration:*

Long Session (or any session longer than 13 weeks)

Starting date of class plus 6 calendar days .....
Starting date of class plus 20 calendar days .....
Starting date of class plus 34 calendar days .....
Starting date of class plus 35 calendar days to end .....

Intermediate Session (9 weeks, 1 day per week)

Starting date of class plus 6 calendar days .....
Starting date of class plus 13 calendar days .....
Starting date of class plus 20 calendar days .....
Starting date of class plus 21 calendar days to end .....

Short Session (7 weeks, 2 days per week)

Starting date of class plus 2 calendar days .....
Starting date of class plus 8 calendar days .....
Starting date of class plus 15 calendar days .....
Starting date of class plus 16 calendar days to end .....

Mini Session (3 weeks)

Starting date of class plus 1 calendar day .....
Starting date of class plus 5 calendar days .....
Starting date of class plus 9 calendar days .....
Starting date of class plus 10 calendar days to end .....

No refund will be made for sessions of less than 21 days.

Refund policies of the University are in conformity with guidelines refunds as adopted by the American Council on Education.

In no case will tuition be reduced or refunded because of absence f classes.

Authorization to withdraw and certification for work done will not given a student who does not have a clear financial record.

Students are encouraged to provide their own cash funds until t can make banking arrangements in the community.

FINANCIAL AID

FOR UNDERGRADUATE STUDENTS*

George Washington University offers a program of financial assista of two basic types: awards for academic achievement without refere

* For information concerning financial aid for students from foreign countries, see page

hancial circumstances—honor scholarships; and scholarships, grants, s, and employment based upon demonstrated financial need.

nor Scholarships—George Washington University honor scholarships o to half-tuition for the academic year, based entirely upon academic evement and potential without regard to financial need, are restricted coming freshmen.

eed-based Aid—The University offers extensive programs of scholar-s, grants, loans, and employment based upon demonstrated need. The versity participates in the National Direct Student Loan, Pell Grant merly Basic Educational Opportunity Grant), Supplemental Educational ortunity Grant, and the College Work-Study programs.

pplications and supporting credentials for financial aid must be filed ebruary 1 (entering freshmen) or March 1 (enrolled undergraduate or ring transfer students) preceding the academic year of the award the fall semester; by November 1 for the spring semester; and by l 1 for the summer sessions.* A student must reapply for all financial including scholarships, each year.

mplete information concerning financial assistance is contained in student financial aid pamphlet, which is available at the Office of lent Financial Aid, George Washington University, Washington, D.C. 2.

he following scholarships are available to students in Columbian ege of Arts and Sciences, the School of Education and Human De-pment, the School of Government and Business Administration, and School of Public and International Affairs.

he *George Washington University Board of Trustees Scholarships*— - and partial-tuition scholarships begin in the fall semester and may renewed for four successive academic years, provided the holder re-lies by the published deadlines, maintains a *B* average, and continues e in financial need. Candidates must plan to select a curriculum leading bachelor's degree in any school listed above. Students who have dem-trated outstanding ability in interscholastic speech and debate activities eligible for the George F. Henigan Scholarships in Debate which are uded among these scholarships.

er Scholarships

ievement Rewards for College Scientists (ARCS) Foundation, Inc., cholarship
rman Page Allen Memorial Scholarship Fund (1966)
mni Scholarships
y J. Anderson Scholarship (1969)
letic Scholarship Fund (1979)
he and Company Scholarships
on Andrews Scholarship (1920)
ry N. Brawner, Jr., Foundation Scholarship Fund (1963)
na K. Carr Scholarships (1932)

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ly students who are enrolled in this University for at least six semester hours in the im-ately preceding spring semester or who have applied for financial aid for the following fall ester are eligible for consideration for Summer Sessions financial aid, providing that they graduate at the end of that summer or the following fall semester or are required by their ram to attend the summer sessions.

Maria M. Carter Scholarship (1871)
Paul E. Casassa Memorial Foundation Scholarship (1968)
The Chesapeake and Potomac Telephone Company Scholarship (1978)
Columbian Women Scholarship Funds
Victoria Briggs Scholarship Fund (1959)
Elizabeth V. Brown Scholarship Fund (1925)
Grace Ross Chamberlin Scholarship Fund (1932)
College Women's Scholarship Fund (1926)
Columbian Women Members' Scholarship Fund (1961)
Arline Hughes Dufour Scholarship Fund (1961)
Dr. Watson W. Eldridge, Jr., and John F. Eldridge Scholarship (1964)
Founders of Columbian Women Scholarship Fund (1920)
Rose Lees Hardy Foundation Scholarship Fund (1957)
Lillian Young Herron Scholarship Fund (1925)
Nellie Maynard Knapp Scholarship Fund (1915)
Marcia B. Kraft Scholarship Fund (1966)
Janet McWilliams Scholarship Fund (1954)
Marie-Louise Ralph Turner Scholarship Fund (1963)
D.C. Daughters of the American Revolution Scholarship (1952)
Isaac Davis Scholarship (1869)
District of Columbia Institute of Certified Public Accountants Schola in Accounting (1964)
Estella Constance Drane Scholarship (1957)
Robert Farnham Scholarship (1871)
Federal Government Accountants Association—Washington, D.C., Ch —Scholarship in Accounting
Esther Brigham Fisher Scholarship (1951)
George Washington University Tennis Alumni Association Schola (1974)
Mildred Green Memorial Scholarship Fund (1959)
Gridiron Foundation of the Gridiron Club Scholarship (1975)
Isadore and Bertha Gudelsky Family Scholarship (1978)
Anna Spicker Hampel Scholarship (1949)
Julian O. Hargrove Scholarship (1968)
Elma Lewis Harvey Scholarship (1921)
Hazleton Scholarship (1950)
George F. Henigan Scholarships in Debate (1967)
Albert A. and Esther C. Jones Scholarship Fund (1981)
Allen M. Jones Scholarship Fund (1981)
David B. and James L. Karrick, Jr., Scholarship Fund (1968)
Samuel and Elizabeth Kay Scholarships (1969)
Amos Kendall Scholarship (1869)
L. Poe Leggette Memorial Scholarship Established by WRGW (1968)
Mary and Daniel Loughran Scholarship (1976)
Martha's Marathon Residence Hall Scholarship (1969)
Maud E. McPherson Scholarship in English and American Literature (1
A. Morehouse Scholarship (1861)
E. K. Morris Education Fund Scholarships (1972)
Helen Marie and Thomas E. Orr Scholarships (1965)
Hardy Pearce Scholarship Fund (1972)

Delta Gamma Scholarships (1956)
B. and Alma D. Pletcher Scholarship Fund (1968)
n M. Powell Scholarships (1886)
arch Assistantships in Operations Research and Related Fields (see
ges 35-36)
dent Assistantships (see page 36)
ry Whitefield Samson Scholarship Fund (1966)
M. Shepard Scholarships (1946)
red Shott Scholarship Fund (1981)
a Delta Chi Foundation of Washington, D.C., Scholarships
garet Lucille Snoddy Scholarship (1970)
d Spencer Scholarship (1918)
y Lowell Stone Scholarship (1893)
les Clinton Swisher Scholarships (1941)
Office of Education Traineeships (1964)
ersity Players Scholarship in Memory of L. Poe Leggette (1968)
iam Walker Scholarship (1824)
ail Ann Brown and Henry Kirk White Scholarship Fund (1963)
Withington Scholarship (1830)
nen's Physical Education Alumnae Association Scholarship (1964)
iam G. Woodford Scholarship (1969)
n Woodhull Scholarship (1919)
ta Club Scholarship (1950)

nts

following funds have been established to meet the special needs of dvantaged students from the District of Columbia Inner-City and the hington metropolitan area.

rge Washington University's Educational Opportunity Program Tuition rants (1968)
Club of Walt Whitman High School, Bethesda, Md., Grant (1968)
riott Foundation Grant (1968)

GRADUATE STUDENTS*

George Washington University program of financial assistance for luate students includes assistantships, fellowships, traineeships, grad- scholarships, research appointments, part-time employment, and loans. lication for admission to graduate study is a prerequisite for con- ration.

pplication and correspondence concerning assistantships, fellowships, neeships, or graduate scholarships should be sent directly to the dean he school concerned, and addressed to George Washington University, shington, D.C. 20052. Unless otherwise specified, application and sup- ing credentials should be submitted no later than February 1 pre- ing the academic year for which the award is made.

istantships

earch Assistantships in Operations Research and Related Fields— ilable to graduates, and to undergraduates on the junior and senior

* information concerning financial aid for students from foreign countries, see page 39.

levels, in any school of the University. Research assistants are exp to work 20 hours a week conducting research in support of an establ research program, in programming or in conducting individual researc an approved research project. Stipends range up to $8,000, dependi the status of the student and the tenure of the appointment (9–12 mo Further information and applications are available from Director, Ins for Management Science and Engineering, School of Engineering an plied Science, George Washington University, Washington, D.C. 20052.

Resident Assistantships (men and women)—Available to graduate dents and seniors in any field of study who are interested in working the student personnel program in University residence halls. Specific vary with the position, but basically consist of counseling, advising st groups, and administration. Remuneration includes partial tuition furnished room for the academic year. All positions are part-time staff members are required to enroll as full-time students in degree ing programs. Further information may be obtained from the Offi the Director of Housing.

Health Services Administration Research Assistantships
National League of Cities/George Washington University Assistantshi
Urban Affairs Assistantship

Fellowships, Internships, Traineeships, Special Programs

The following fellowships, internships, and traineeships are availab students in the Graduate School of Arts and Sciences, the School of E tion and Human Development, the School of Government and Busines ministration, and the School of Public and International Affairs. The versity also offers many other fellowships which are available to stu in these colleges and schools.

University Fellowships—Available to graduate students in master doctoral programs in most departments of the University. Fellowship based on scholarship and each fellow may receive a stipend, tuition a ance, and course fees.

Graduate Teaching Assistantships—Available to graduate studen master's and doctoral programs in most departments of the Universi graduate teaching assistant receives financial compensation for a nated unit of service to the assistant's major department of instructi

Research Traineeships—Available under numerous sponsored prog in a number of departments. Currently, the basic medical science de ments and the Departments of Psychology and Speech and Drama such programs. Stipends vary; information is available from the de ments and the Office of the Dean of the Graduate School of Arts Sciences.

Achievement Rewards for College Scientists (ARCS) Foundation, Fellowship
Robert A. Aleshire Fellowship Fund (1971)
American Association of Collegiate Schools of Business Fellowship
American Civilization Fellowships
American Civilization Internships (Smithsonian Institution-George W ington University Cooperative Program)
American Iron and Steel Institute Fellowship

ur Anderson & Co. Doctoral Fellowship
mehr Research Fellowships
ield Scott Blaney Fellowship in International Affairs (1961)
er T. Carr, Sr., Memorial Fellowship in Urban and Regional Planning
973)
nas Alva Edison Fellowship
entary Teacher Education Internships
t & Ernst Grant to Doctoral Candidates in Business or Economics
th Services Administration Fellowships
ard D. Irwin Doctoral Fellowships
ella Osborn King Research Fellowships (1927)
a D. Lasker Fellowships in Housing, City Planning, or Urban Renewal
y and Daniel Loughran Graduate Scholarship (1976)
rge McCandlish Fellowship in American Literature (1980)
on Foundation Fellowships
orities in Planning and Related Professions Program
onal Association of Purchasing Management Fellowship
onal Historical Publications Commission-George Washington Uni-
rsity Cooperative Research Fellowships
onal Science Foundation Graduate Fellowships
ources for the Future, Inc., Fellowship Prize
e Bibliography Internships
mas Bradford Sanders Fellowships (1928)
ttish Rite Foundation Fellowships
Office of Education Fellowships (1964)
Public Health Service Traineeships
Public Health Service Traineeships in Comprehensive Health Planning
an Studies Fellowships of the Department of Housing and Urban De-
elopment
an Transportation Center Fellowship
ald Barbour Weintraub Research Fellowship in Biological Sciences
980)

duate Scholarships

ed Forces Health Professions Scholarship Program (The Uniformed
ervices Health Professions Revitalization Act of 1972—Public Law
2-426)
bee Sculptor Scholarship (1975)
na K. Carr Scholarships (1932)
rict of Columbia Institute of Certified Public Accountants Scholarship
Accounting (1964)
etics Graduate Scholarship (1979)
ert A. and Esther C. Jones Scholarship Fund (1981)
n M. Jones Scholarship Fund
ron L. Loe Scholarship Fund (1975)
y and Daniel Loughran Graduate Scholarship (1976)
ter G. McGaw Scholarship in Health Care Administration (1971)
l Pearson Scholarship Fund (1940)
Delta Gamma Scholarship Fund (1968)
rhees Scholarships
lcott Foundation Scholarships

Sponsored Awards for Graduate Study

Information regarding awards sponsored by foundations, professiona learned societies, industries, and others which may be used in suppo graduate study is available at the Graduate Fellowship Information ter, 2025 H St., N.W., for students enrolled at George Washi University. Information is also available on distinguished programs su the Rhodes, Marshall, National Science Foundation, Fulbright, Luce Rotary International, as well as many others.

As deadlines for application vary, qualified students should mak quiries well in advance of the year of planned graduate study.

LOAN FUNDS

The following loan funds are available to undergraduate and/or gra students in Columbian College of Arts and Sciences, the Graduate S of Arts and Sciences, the School of Education and Human Develop the School of Government and Business Administration, and the S of Public and International Affairs. A separate application must be mitted for all loan programs. Applications for the National Direct St Loan should be filed no later than April 1 for the following academic Complete information is contained in the student financial aid pam which is available from the Office of Student Financial Aid, George W ington University, Washington, D.C. 20052.

American Medical Association Nursing Home Administration Loan Fu
George F. Henigan Loan Fund (1975)
International Student Loan Fund (1967)
Joanne Jacobs Student Loan Fund (1974)
W. K. Kellogg Foundation Hospital Administration Loan Fund
Jessie B. Martin Loan Fund (1967)
National Direct Student Loan Program
Ellis H. Stearman Emergency Loan Fund
Hiram Miller Stout Memorial Loan Fund (1973)
University Student Emergency Loan Fund

Guaranteed Student Loan Program

George Washington University is an eligible participant in the Fede Insured State Guaranteed Student Loan Program. Undergraduate stud may apply for a maximum of $2,500 per year. Graduate students apply for a maximum of $5,000 per year. Students who intend to the loan for payment of tuition at registration should submit an applic no later than June 1. Preregistered students planning to use their to hold their registration should apply by May 1.

STUDENT EMPLOYMENT

The University participates in the College Work-Study Program. Inqu should be addressed to the Office of Student Financial Aid. In addition Student and Alumni Career Services Office maintains a registry of full-time and part-time positions available in the Washington area undergraduate and graduate students.

ter registration, students may apply at the Student and Alumni Career ices Office, Woodhull House, 2033 G Street, N.W., for interviews and rals to positions for which they are qualified.

ERNATIONAL STUDENTS

ergraduate international students with proven financial need who have pleted one semester of full-time work (15 hours) at this University a *B* average are eligible to apply for the Board of Trustees Scholar-. Scholarships are awarded in the spring for the following academic See instructions for applying for undergraduate financial aid, pages .

nited awards for graduate teaching assistantships and University wships are the responsibility of the chairman of the department or of the school in which the degree is to be earned. Work as a ning fellow requires excellent knowledge of English—both spoken written.

ng-term loan funds for undergraduate and graduate international stu- s are limited in amount and are available only to those foreign-born ons who have established resident status in the United States through Immigration and Naturalization Service.

e suggest that students who wish to study in the United States have lable sufficient funds to cover expenses for one full year before at- pting to enter a college or university. The cost at this University for academic year (September-May) is approximately $9,400. This estimate ades room and board, tuition, books, clothes, and incidental expenses; ravel, holiday, or medical expenses are included.

IZES

ccounting Prizes—Three prizes for academic excellence awarded an- ly by the Department of Accounting—two at the undergraduate level one at the Master of Accounting level.

Jorris M. Aein Memorial Prize—Awarded to a deserving student for llence in drawing.

lpha Chi Sigma Prize—Awarded annually by the Alpha Pi Chapter to student who has attained the highest academic record in courses in mistry. The name and year of graduation of the student is inscribed on onze plaque. The winner must have had at least 16 hours in chemistry, uding the final semester at this University.

merican Chemical Society Prize—Awarded to an undergraduate stu- t who has completed the junior year and who has demonstrated ex- ence in analytic chemistry.

merican Institute of Chemists Prize—A medal awarded annually to the duating student majoring in chemistry who excels in scholarship, in- rity, and leadership.

Department of Art Prizes—Two prizes—one for a senior in art h and one for a senior in the fine arts—awarded annually to the most p ing students, as determined by the departmental faculty.

The Walter G. Bryte, Jr., Achievement Award—Provided by Walt Bryte, Jr., Colonel, U.S. Air Force (retired), first Professor of Air Scie George Washington University. The award is presented annually prin to that undergraduate residence hall, secondarily to any other activ the University, which has shown under the leadership of its elect designated head, the most improvement or excellence in its support principles and aims of the United States of America and George W ington University. The hall or other activity will be awarded a cash and the name of its leader and the hall or activity will be engraved silver trophy.

Buka Family Prize—Provided by Ruth Buka in honor of her pa Georg and Rosa Buka, and her sister, Hilde Buka-Lacour. It is aw to the most outstanding student in the Department of Germanic Lang and Literatures.

Byrne Thurtell Burns Memorial Prize—Awarded to the senior major chemistry who shows the greatest proficiency in organic chemistry, a denced by a comprehensive examination, and who possesses such qual tions of mind, character, and personality as to give promise of f achievement.

Business Administration Prize—Awarded annually by the Departme Business Administration to the outstanding graduating senior in bus administration on the basis of scholarship, leadership and service t University.

Wilbur J. Carr Prize—Established in 1962 by Edith K. Carr, former tee of the University, in memory of her distinguished husband, who graduated from the School of Comparative Jurisprudence and Diplo in 1899. It is awarded annually to that student in the graduating cla the University who has demonstrated outstanding ability in the stud international affairs and who has given evidence of possessing in me degree the qualities which produce the good citizen and the dedic public servant.

Chemical Rubber Company Freshman Chemistry Achievement Pr A Handbook of Chemistry and Physics awarded annually to the fres student who has demonstrated the greatest achievement in Chemistry 1

Chemical Society of Washington Prize—Awarded to an outstan undergraduate in the junior year who is majoring in Chemistry.

Astere E. Claeyssens Prize—Established in 1981 by the Trustees o Bess and Arthur Dick Family Foundation. It is awarded for the best ori work in playwriting by a student enrolled in the University.

Jerome Cornfield Memorial Prize—Awarded annually to the stu who has written the best Ph.D. dissertation in the Department of Stati

John Henry Cowles Prizes—Two prizes, established by John H. Cow Grand Commander of the Supreme Council of Thirty-third Degree (Mo Council of the World) of the Ancient and Accepted Scottish Rite of F masonry, Southern Jurisdiction of the United States of America. Awa annually to the senior in the School of Government and Business A ministration and to the senior in the School of Public and Internati Affairs with the highest academic averages.

DeWitt Clinton Croissant Prize—Awarded annually to the undergraduate
ident enrolled in a course in drama or active in University dramatics who
bmits to the English Department the best essay on drama or the theater.
E.K. Cutter Prize—Established by Marion Kendall Cutter "for excellence
the study of English." Awarded to the member of the graduating class
ose record in English, combined with general excellence, shows most
rked aptitude for and attainment in English studies.
Isaac Davis Prizes—Established in 1847 and awarded annually to the
ee seniors who have made the greatest progress in public speaking while
rolled in the University. Awards are to be determined by a public-
eaking contest in which the participants deliver original orations. Only
embers of the senior class of Columbian College of Arts and Sciences
o are candidates for the degree of Bachelor of Arts or Bachelor of
ience are eligible to compete.
Dimock Gallery Prize—Purchase award presented for creative achieve-
nt in the fine arts.
Henry Grattan Doyle Memorial Prize—Established in memory of Henry
attan Doyle, a former Dean of Columbian College. Awarded annually to
outstanding senior for excellence in Spanish.
Elton Prize—Established by the Reverend Romeo Elton, of Exeter, Eng-
nd, and awarded annually to the student with the highest average in the
ost advanced course in the Greek language and literature.
Jesse Frederick Essary Prize in Journalism—Established by Helen Essary
urphy and awarded annually to a student who has given promise of
und citizenship and who submits the best printed and published evidence
ability in "forthright reporting" and good journalistic writing, in a stu-
nt publication or elsewhere.
Jessie Fant Evans Prize—A bequest of Joshua Evans, Jr., in 1971, in
cognition of his wife's distinguished record at and service to the Uni-
rsity, on whose Board of Trustees she served as the first woman member.
varded annually to an outstanding senior student in a contemporary
tory course.
Joshua Evans III Prize in Political and Social Science—A memorial prize
stablished by friends because of an outstanding life." Awarded an-
ally to that student in the graduating class "who has demonstrated his/
r signal ability in the social and political sciences and who has given
omise of the interpretation of that ability in good citizenship among his/
r fellows."
Willie E. Fitch Prize—Established by James E. Fitch in memory of his
n. Awarded annually to a senior student for the best examination in
emistry.
Charles E. Gauss Prize—Established in honor of Charles E. Gauss,
ton Professor of Philosophy from 1945 to 1964. Awarded annually to a
aduating senior for excellence in philosophy.
Alice Douglas Goddard Prize—A memorial established by Frederick
seph Goddard, of Georgetown, D.C. Awarded annually to the senior
ident making the highest average in American literature.
Edward Carrington Goddard Prize—Established by Mary Williamson
oddard, Alice Douglas Goddard, and Frederick Joseph Goddard, of
eorgetown, D.C., in memory of Edward Carrington Goddard, class of

1881. Awarded to the junior or senior student making the highest ave in the French language and literature.

Morgan Richardson Goddard Prize—A memorial established by M Williamson Goddard, Alice Douglas Goddard, and Frederick Joseph G dard, of Georgetown, D.C. Awarded to the junior or senior student ma the highest average in the following fields: business administration, nomics, international business, or public accounting.

Gardiner G. Hubbard Memorial Prize in United States History—Es lished by Gertrude M. Hubbard in memory of her husband and awar annually to that member of the graduating class majoring in history has maintained the highest standing in courses in United States histor

International Business Prize—Two prizes awarded annually by School of Government and Business Administration to students speci ing in international business, one awarded to a graduating senior and awarded to a graduate student.

Elmer Louis Kayser Prize—Established by Paul and Elizabeth Ruthe to be awarded annually by the Department of History for the best thesi history submitted by a candidate for the degree of Master of Arts.

David Lloyd Kreeger Prizes in Art—Five prizes given by Mr. Kree three in the fine arts and two in art history (including museology). arts prizes are awarded to a senior or graduate student in painting, sc ture, graphics, design, ceramics, or photography. One prize in art hist is awarded to a senior and one to a graduate student. Candidates for prizes must submit original papers or works of art. Winners are selec by distinguished representatives of the field of art in the Washington, D area.

Minna Mirin Kullback Memorial Prize—Established in 1968 by Solon Kullback in memory of his wife. Awarded annually by a committee faculty members of the Department of Statistics to a full-time und graduate or graduate student majoring in statistics, who will have co pleted 18 semester hours of statistics courses by the end of the sp semester.

John Francis Latimer Prize in Classics—Established in 1973. Awar to a graduating senior who has made the most outstanding record major in the Department of Classics.

Hilda Haves Manchester Prize in Sociology—Established in honor Hilda Haves Manchester, B.A. 1932, an outstanding student whose ma field was sociology. Awarded annually by Columbian College of and Sciences to the senior student majoring in sociology who has highest scholastic record.

Vivian Nellis Memorial Prize—Awarded to a student in the English partment who has shown special promise in the field of creative writing

Phi Delta Kappa Prize—Awarded annually by the George Washing University Chapter to an outstanding senior in a teacher education pr gram in the School of Education and Human Development.

Phi Delta Kappa Research Prize—Awarded annually by the Geo Washington University Chapter to a graduate student, for an outstand research project.

Phi Eta Sigma Prize—A choice book selected from the field of the cipient's major, awarded annually by the George Washington Univers Chapter to the student attaining the highest scholastic average in the f

semester of work. The winner's name is engraved on a plaque in the ice of the Dean of Columbian College of Arts and Sciences.

i Lambda Theta Prize—Awarded annually by Alpha Theta Chapter to outstanding senior in a teacher education program in the School of ucation and Human Development.

si Chi Prizes—Two prizes awarded annually by the George Washington iversity Chapter to the best undergraduate student in experimental psy- logy and to the M.A. degree candidate or second-year graduate student mitting the best thesis or research project in psychology.

uggles Prize—Established by Professor William Ruggles in 1859, arded annually to a candidate for a bachelor's degree for excellence in thematics.

he Jack and Anne Ryan Award in Health Services Administration—arded annually to that Health Services Administration student who dis- ys excellence of analysis and writing skills in the preparation of a per on a topic in health services administration.

Hermann and Johanna Richter Schoenfeld Prize—Established in grateful preciation of the inspired teaching and devotion to his students of Dr. rmann Schoenfeld, who for more than 20 years until his death in 1926 aded the Department of German. Hermann Schoenfeld, Ph.D., LL.D., s widely recognized as a scholar of distinction whose presence on the ulty added prestige to the University. This prize is given annually to a mber of the graduating class for excellence in historical and cultural ases of German studies.

ulian H. Singman Prize—Awarded for creative achievement in the field design.

Society of Colonial Wars in the District of Columbia Prize—A cash ze awarded to a candidate for a graduate degree who, in the judgment the faculty of the Department of History, submits a thesis or disserta- n demonstrating excellence in historical research in American Colonial tory. The University reserves the right to withhold the award if no esis or dissertation attaining the required degree of excellence is sub- tted.

Staughton Prize—Established by the Reverend Romeo Elton and awarded nually to the student making the best record in the most advanced urses in the Latin language and literature.

Alfred E. Steck Memorial Prize—Awarded for proven excellence in the d of sculpture.

James MacBride Sterrett, Jr., Prize—Established in 1911 by Professor errett in memory of his son. Awarded annually to the student who ob- ns the highest average in Physics 1 and 2.

Charles Clinton Swisher Historical Club Prize—Established in 1936 by e Charles Clinton Swisher Historical Club and augmented in 1941 by the quest of Professor Swisher. Awarded annually to the student who sub- ts the best essay covering some phase of medieval history.

James H. Taylor Graduate Mathematics Prize—Established in memory of nes H. Taylor, former Professor of Mathematics at the University. varded annually to a graduate student for outstanding performance in athematics.

Patricia M. Toel Memorial Prize—Awarded annually to a graduate stu- nt in photography to recognize outstanding achievement.

Benjamin D. Van Evera Memorial Prize—Awarded annually to Graduate Teaching Fellow in Chemistry selected as the most effe teacher during the current academic year.

The Wall Street Journal Leadership Prize—Awarded annually to a uating senior with a major field of study in finance within the Bac of Business Administration degree, for outstanding academic perform and service to the University.

Thomas F. Walsh Prize—Established in 1901 and awarded annuall the student who submits the best essay in Irish history.

The Washington Society of Investment Analysts Award—A $500 a given to a full-time candidate for the Master of Business Administra degree who is interested in finance and investments, has a high un graduate academic record, and demonstrates financial need.

Alexander Wilbourne Weddell Prize—Established in 1923 by Virg Chase Weddell in memory of her husband. Awarded annually to a de candidate who writes the best essay on "the promotion of peace am the nations of the world." The prize essays shall become the propert the University and shall not be printed or published without the wri consent of the University. The University reserves the right to with the award if no essay attaining the required degree of excellenc submitted.

Women's Transportation Seminar Prize—Awarded annually by Women's Transportation Seminar to an outstanding student specializ in transportation in the School of Government and Business Administrat

REGULATIONS

Students enrolled in the University are required to conform to the follo ing regulations and to comply with the rules and regulations of the colle school, or division in which registered.

Students who withdraw or are suspended, or who, for any other reas are not registered at the University for one semester or more, may re-en and continue work only under the regulations and requirements in fo at the time of return.

If a student knowingly makes a false statement or conceals mate information on an application for admission, registration card, or any ot University document, the student's registration may be canceled. If su falsification is discovered after the student has established an academ record at the University, the student may be subject to dismissal fro the University. Such a student will be ineligible (except by special act of the Faculty) for subsequent registration in the University.

ATTENDANCE

Students may not attend classes until registration is completed and f due are paid. They may attend only those classes for which they

istered. Regular attendance is expected. Students may be dropped from y course for undue absence.

CHOLARSHIP REQUIREMENTS

tudents who fail to maintain the scholarship requirements of the college, hool, or division in which registered may be dismissed from the Uni- rsity.

ades

rades are mailed to students through the Office of the Registrar at the ose of each semester. They are not given out by instructors.

NDERGRADUATE

he following grading system is used: *A*, Excellent; *B*, Good; *C*, Satisfac- ry; *D*, Low Pass; *F*, Fail; *I*, Incomplete; *IP*, Progress; *W*, Authorized With- awal; Z, Failure, Unauthorized Withdrawal; *P*, Pass; *NP*, No Pass. xcept for courses which specifically state that repetition for credit is ermitted, a candidate for a degree at this University may not repeat for redit a course in which a grade of *D* or better was received, unless re- ired to do so by the department concerned. A written statement to is effect must be submitted to the Registrar by the appropriate depart- ent chairman.

RADUATE

he following grading system is used: *A*, Excellent; *B*, Good; *C*, Minimum ass; *CR*, Credit; *F*, Fail; *I*, Incomplete; *IP*, Progress; *P*, Pass; *NP*, No Pass; , Authorized Withdrawal; Z, Failure, Unauthorized Withdrawal. Except r courses which specifically state that repetition for credit is permitted, a andidate for a degree at this University may not repeat for credit a course which a grade of C or above was received, unless required to do so by e department concerned. A written statement to this effect must be sub- itted to the Registrar by the appropriate department chairman.

COMPLETE/AUTHORIZED WITHDRAWAL

hen another grade has not been assigned, the symbol *I* (Incomplete), the mbol *W* (Authorized Withdrawal), or the symbol Z (Failure because unauthorized withdrawal) will be recorded. The symbol *I* indicates at a satisfactory explanation has been given the instructor for the udent's inability to complete the required work of the course. At the tion of the instructor, the grade of *I* may be recorded if a student, for asons beyond the student's control, is unable to complete the work of e course, and if the instructor is informed of, and approves, such reasons fore the date when grades must be reported. The grade may be used ly if the student's prior performance and class attendance in the course ave been satisfactory. Any failure to complete the work of a course which not satisfactorily explained to the instructor before the date when grades ust be turned in will be graded *F*. If acceptable reasons are later pre- nted to the instructor, that instructor may initiate an appropriate grade ange.

REMOVING AN INCOMPLETE

For information concerning the removal of a grade of Incomplete fr student's record, consult the regulations of the college, school, or div concerned.

THE QUALITY-POINT INDEX

Scholarship is computed in terms of the quality-point index, obtaine dividing the number of quality points by the number of semester for which the student has registered, both based on his or her record i University. Quality points are computed from grades as follows: *A*, points; *B*, three points; *C*, two points; *D*, one point; *F* and *Z*, no point each semester hour for which the student has registered. Courses m *CR*, *I*, *IP*, *P*, *NP*, or *W* are not considered in determining the index, e that courses marked *I* will be considered when a final grade is reco With the exception of Consortium courses, grades in courses tak other institutions are not considered in computing the quality-point in

Final Examinations

Final examinations for undergraduate courses are scheduled by the of the Registrar. Examinations for courses numbered 201 or abov scheduled, if desired, by the individual department or instructor.

Academic Dishonesty

The University community, in order to fulfill its purposes, must est and maintain guidelines of academic behavior. All members of the munity are expected to exhibit honesty and competence in their aca work. Incoming students have a special responsibility to acquaint selves with, and make use of, all proper procedures for doing res writing papers, and taking examinations.

Members of the community will be presumed to be familiar wit proper academic procedures and held responsible for applying Deliberate failure to act in accordance with such procedures w considered academic dishonesty. Acts of academic dishonesty are a moral, and intellectual offense against the community and will be cuted through the proper University channels.

Copies of the University policy on academic dishonesty can b tained from the following officers: all department chairmen, all aca deans, and the Vice President for Academic Affairs.

STUDENT CONDUCT

All students upon enrolling and while attending The George Washi University are subject to the provisions of the *Statement of St Rights and Responsibilities* which outlines student freedoms and res bilities of conduct, the Judicial System for Non-Academic Studen cipline, and other policies and regulations as adopted and promulgat appropriate University authorities. Copies of these documents m obtained at the Office of the Vice President for Student Affairs. San for violation of these regulations may include permanent expulsion

University which may make enrollment in another college or university ficult. Regulations or requirements applicable only to a particular pro-m, facility, or class of students may not be published generally, but h regulations or requirements shall be published in a manner reason-y calculated to inform affected students.

ITHDRAWAL

thdrawal from a course or from the University requires the permission the dean of the college, school, or division in which the student is regis-ed. Permission to withdraw from the University will not be granted a dent who does not have a clear financial record (see "Payment of es").

Each college, school, and division of the University sets deadline dates each semester concerning withdrawal. Withdrawal between these dates d the end of the semester is permitted only in exceptional circum-nces.

All charges for courses dropped without the approval of the dean must met by the student. Such unauthorized withdrawal will result in the cording of a failing grade for the course or courses.

HANGES IN PROGRAM OF STUDY

anges within a College, School, or Division—A student may not sub-tute one course for another, drop courses (see "Withdrawal" above), ange status from credit to audit or from audit to credit without the ap-oval of the dean of the college, school, or division in which registered.

Change from one section to another of the same course may be made th the approval of the dean and the department concerned.

Change from one major field to another within the same college or hool may be made with the approval of the dean.

Transfer within the University—Application for transfer to another col-ge, school, or division must be made to the appropriate admitting office the form provided by the deans concerned. Transfer from the appro-iate preprofessional curriculum in Columbian College to bachelor's de-ee candidacy in the School of Public and International Affairs may take ace upon the completion of 60 or more semester hours of course work d of the necessary procedures required by the particular school.

With the exception of the School of Government and Business Admini-ration which limits a student to 15 semester hours earned in non-atriculated status, a maximum of 45 semester hours earned in the vision of Continuing Education and Summer Sessions may be applied ward a bachelor's degree in the other degree-granting colleges or schools the University.

Students transferring within the University are advised to study care-lly the requirements listed below under the heading "Graduation Re-uirements," and to note that, unless otherwise specified, in all under-aduate divisions, 30 semester hours, including at least 12 semester hours the major field, must be completed while registered in the school or ollege from which the degree is sought. Upon transfer the student should onsult the dean concerned and understand clearly the requirements hich must be fulfilled.

CREDIT

Credit is given only after registration for a course and satisfactory com tion of the required work, or upon the assignment of advanced stan in accordance with the regulations of the several colleges, schools, divisions.

Auditing—A person who has been admitted to the University ma registered, with the permission of the instructor, as an auditor in a (no academic credit). An auditor is not required to take active part o pass examinations. A student who takes a course as an auditor may repeat it later for credit.

POST-ADMISSION TRANSFER CREDIT

Students who plan to attend another institution and apply credit so ear toward graduation from this University, must first secure the written proval of their dean. In no event will credit in excess of what might earned in a similar period in this University be recognized.

BALANCE SHEET

On request, the Office of the Registrar will issue to undergraduate deg candidates a balance sheet showing the amount of work completed and requirements remaining to be met for the degree. A second balance sh is issued only if the student changes major or degree objectives.

TRANSCRIPTS OF RECORD

Official transcripts of student records are issued on written request of student or former student who has paid all charges, including any stud loan installments, due the University at the time of the request. A fee $2 is charged for each transcript. When more than two transcripts ordered at the same time, a $2 fee is charged for each of the first t transcripts and a $.50 fee is charged for each additional transcript. Par transcripts are not issued.

CONTINUOUS ENROLLMENT

Once entered in a degree program, a student is expected to be continuou enrolled and actively engaged in fulfilling the requirements for the deg each semester of the academic year until such time as the degree is co ferred. Should the student break continuous enrollment at the Univers and not request and be granted a leave of absence (see below) or assigned by the dean to inactive status (see below) he or she must ap for readmission and, if granted, be subject to the requirements and regu tions then in force.

LEAVE OF ABSENCE

Should a degree student find it necessary to interrupt active pursuit of th degree, he or she may petition the dean for a leave of absence for specific period of time, generally limited to one calendar year. A degr student who discontinues active enrollment in degree studies witho being granted a leave of absence, or a student granted a leave who do

eturn to active study at the close of the period of approved absence, apply for readmission and be subject to the regulations and re-ments then in force. No fees are assessed students while on leave sence.

CTIVE STATUS

er the regulations established by each school and college, a student be considered in continuous pursuit of the degree while not enrolled urses at the University when engaged in the following: cooperative neering work semester; "year abroad program"; attendance at an-r institution with prior approval to have work transferred back to the program; completion of outstanding work in courses in which a e of "Incomplete" was received; or non-course instructional activities ue to the particular school or college.

udents must request to be enrolled in inactive status, in advance of year or semester concerned, and be granted approval by their dean the specific activity desired. This status is generally limited to one ; no fees are assessed students while in this status.

ADUATION REQUIREMENTS

rees are conferred in February, May, and September.

o be recommended by the Faculty for graduation a student must have the admission requirements of the college or school in which regis-d; completed satisfactorily the scholarship, curriculum, residence and er requirements for the degree for which registered; and be free from ndebtedness to the University. Enrollment is required for the semester ummer session at the close of which the degree is to be conferred.

pplication for Graduation—An "Application for Graduation" form st be filed and the appropriate fee paid at the time of registration for last semester or summer session of the senior or final year. Students npleting degree requirements during the Summer Sessions will be arded diplomas (no formal convocation) dated September 30, *provided* y have completed all degree requirements and have applied for gradua-as a part of registration for the Summer Sessions.

cholarship—The student must meet the scholarship requirements for particular degree for which registered.

Curriculum—Minimum curriculum requirements for each degree are ted under the college or school offering work in preparation for the ree.

Residence—Unless otherwise specified, in all undergraduate divisions the University, a minimum of 30 semester hours, including at least 12 rs in the major field, must be completed while registered in the school college from which the degree is sought. This requirement applies to dents transferring within the University as well as to students trans-ring from other institutions. Unless special permission is granted by dean of the college or school concerned to pursue work elsewhere, work of the senior or final year must be completed in the college or ool from which the degree is sought.

The graduate student must meet the residence requirements for the rticular degree for which registered.

Attendance and Conduct—The University reserves the right to
to confer a degree upon a candidate whose attendance or conduct ha
unsatisfactory.

Thesis or Dissertation—A thesis or dissertation submitted in
fulfillment of requirements for a degree must be presented in it
form to the dean of the college or school concerned no later than th
specified in the University Calendar.

Accepted theses and dissertations, with accompanying drawin
come the property of the University and are deposited in the Uni
Library, where the duplicate copies are bound and made availa
circulation. See the appropriate college or school in this bulle
regulations governing theses and dissertations.

HONORS

WITH DISTINCTION

In all undergraduate divisions of the University a baccalaureate
may be conferred "With Distinction," at the discretion of the facul
student meets the specific requirements of the college or school as f

1. Columbian College of Arts and Sciences or School of Publ
International Affairs—the attainment of the grades of *A* in 60 per
the courses taken at GW; or

2. School of Education and Human Development or School of G
ment and Business Administration—the attainment of a quality-point
of 3.50 or higher in all course work taken at GW.

To be eligible a student must have completed at this institution a
one-half of the courses required for the degree.

SPECIAL HONORS

Special Honors may be awarded by the faculty to any member
graduating class for outstanding achievement in the student's majo
on recommendation of the major department. The student must fu
of the following requirements:

1. Candidacy for Special Honors must be approved by the faculty
ber representing the major department or field not later than the beg
of the senior year.

2. Such other conditions as may be set at the time the candid
approved must be met.

3. At least one-half of the courses required for the degree mus
been completed at GW.

4. The specific requirement of the college or school in which reg
must be fulfilled, as follows: (a) Columbian College of Arts and Sc
or the School of Public and International Affairs—grades of *A* or
per cent of the courses taken at GW; or (b) the School of Educati
Human Development or the School of Government and Busines
ministration—a quality-point index of at least 3.0 on all course work
at GW.

THE LIBRARY

All students registered in the University have the privilege of usi
University Library. Its stacks are open, and all students are welco

se. A card denoting approved enrollment for the current semester be presented when books are borrowed for outside use.
e loan period for stack books is 14 days. Any book which circulates bject to recall by the library if needed for reserve or other use. Re- books must be used in the reserve reading room when the library en, except that they may be withdrawn for overnight use beginning 30 p.m. Transcripts of grades are withheld until a student's library d is clear, with all borrowed books returned and any fines paid.
students using the University Library are expected to be familiar its detailed regulations, available at any of the library's service desks.

IT TO DISMISS STUDENTS

right is reserved by the University to dismiss or exclude any student the University, or from any class or classes, whenever, in the interest e student or the University, the University Administration deems it able.

HT TO CHANGE RULES

University and its various colleges, schools, and divisions reserve the to modify or change requirements, rules, and fees. Such regulations go into force whenever the proper authorities may determine.

HT TO MAKE CHANGES IN PROGRAMS

right is reserved by the University to make changes in programs with- notice whenever circumstances warrant such changes.

VERSITY POLICY ON THE RELEASE STUDENT INFORMATION

Family Educational Rights and Privacy Act of 1974 applies to institu- l policies governing access to and release of student education rec- maintained by educational institutions which are recipients of federal s. The University complies with this statute, which states, in part, such institutions must:

afford students access to education records directly related to them;
offer students an opportunity for a hearing to challenge such records as inaccurate, misleading, or otherwise inappropriate;
receive students' written consent before releasing information from their education records to persons outside the University, except as provided by the Act and except for directory information as indicated below. Information may be furnished to a student's parents without such written consent only upon certification of the student's financial dependency; and
comply with a judicial order or lawfully issued subpoena to release a student's record, notifying the student of this action.

he University will release the following directory information upon uest: name, local address, and telephone number; name and address of t of kin; dates of attendance; school, college, or division of enrollment; l of study; credit hours earned; degrees earned; honors received; par-

ticipation in organizations and activities chartered or otherwise esta by the University (including intercollegiate athletics); and heig weight of members of athletic teams. A student who does not wis directory information released must file written notice to this e the Office of the Registrar.

Copies of the University's full policy statement on the release of s information may be obtained from the Office of the Registrar.

PROPERTY RESPONSIBILITY

The University is not responsible for the loss of personal property. and Found Office is maintained on campus in the Safety and S Office.

UNIVERSITY POLICY ON DRUGS

The University cannot condone violations of law, including viola those laws which proscribe possession, use, sale, or distribution of Members of the academic community should know that adminis action, which may include dismissal from the residence halls, revo of other privileges, or suspension or dismissal from the University be taken in order to protect the interests of the University and the of others.

ASSOCIATIONS AND SERVICES

CONSORTIUM OF UNIVERSITIES OF THE WASHINGTON METROPOLITAN AREA, INC.

The universities in Washington, D.C.—American University, Ca University of America, George Washington University, Georgetow versity, Howard University, and the University of the District of Col —are associated in a Consortium through which they coordinate th of their respective facilities; Gallaudet College, Mount Vernon Colleg Trinity College are associate members of the Consortium. Stude approved programs leading to degrees in any one of these insti have the opportunity to select from the combined offerings of a particular courses which best meet their needs.

Participation is limited to degree candidates. The following, ever, are excluded: students in canon law, dentistry, medicine theology. Law students are also excluded from participation, exce candidates for the degree of Master of Laws at George Washingto versity and Georgetown University.

In special courses involving private instruction (such as music o or tutorial study, if a special fee is charged, this fee is not covered Consortium agreement and must be paid by the individual student institution administering the course.

dents are encouraged to study the announcements of programs of all articipating institutions. See page 27 for information concerning ration for Consortium courses.
istration forms and instructions are available from the registrar of stitution in which the student is enrolled. Students register and pay at their own institutions for all Consortium courses; course fees are le to the visited institutions.

READING CENTER

tor F.E. Hesser

Reading Center offers individual diagnostic and corrective services l levels: primary, elementary, secondary, and adult. In addition, spe- eading improvement classes are conducted for high school and col- students as well as other adults. Instruction is available on an in- ual, semi-individual, and small-group basis.
omplete diagnosis includes psychological tests; vision, hearing, domi- , and spelling tests; and various types of reading achievement and de tests. Results are interpreted, and a written report is presented nference with the parents or the individual.
e special reading improvement classes for high school students, col- students, and other adults are offered throughout the year at stated vals. Emphasis is placed on improvement of vocabulary, speed, com- ension, and study skills. Instruction in spelling is also provided as ed.
es—Individuals should contact the Center regarding the fee schedule. ees are payable in advance at the Reading Center, Building C, Suite 2201 G Street, N.W.

SPEECH AND HEARING CENTER

ctor of *Speech-Language Pathology and Audiology* J.W. Hillis

Speech and Hearing Center offers diagnostic and remedial work for ren and adults with such communication difficulties as stuttering, ng, cleft-palate speech, and cerebral-palsied speech; and with voice, ulatory, and hearing problems. Diagnostic and remedial work is also able for persons with nonstandard language usage due to such con- ns as hearing loss, neurological impairment, mental retardation, and ronmental factors.

TER FOR ACADEMIC AND ADMINISTRATIVE COMPUTING

ctor F. William Rambo

Center for Academic and Administrative Computing is located on the l floor of Lisner Hall, 2023 G St., N.W. The computer and other opera- al supportive services are located on the first floor of Stuart Hall, G St., N.W. These facilities normally are available 24 hours a day, n days a week, to all faculty, staff, and students.
he Center provides computational facilities, conducts seminars, con- s with users, and provides operational assistance as required. The ter operates an IBM (OS/VS1) central processing unit and a PDP 11

minicomputer which provides a terminal-based text-editing syst students. There is a full range of compilers and application s packages.

Computer programming courses are offered by the School of G ment and Business Administration, the Department of Statistics, a School of Engineering and Applied Science. In addition, many oth partments offer courses that utilize the computer as a research adju course work.

Any student of the University may have access to the compu class-related or individual research. Access is by request and w charge.

GENERAL ALUMNI ASSOCIATION

President William M. Porter

The objectives of this association are to unite the graduates who w associate themselves for charitable, educational, literary, and sc purposes, and to promote the general welfare of the University.

Membership in the Association is conveyed automatically to anyon has been graduated from any school or division of the University. A who has earned 15 credit hours or the equivalent at the Universit whose class has graduated is eligible for membership; in the case s Division of Continuing Education and Summer Session students, ho only the "15 credit hours earned" requirement and not the "graduat the class" requirement applies. Any persons who are or have been bers of the University's Board of Trustees, faculty, or administrative as well as others determined to qualify by the Governing Boar eligible for membership in the Association.

The affairs of the Association are directed by a Governing Boar majority of whose members represent the constituent alumni of the versity's schools and colleges.

The voluntary leadership of the Association works closely with the of the Alumni Relations Office in carrying out Association affairs Association may be contacted through the Alumni Relations Office.

VETERANS BENEFITS

The Veterans Counselor's office, located on the third floor of Rice Hall Eye St., N.W., assists students entitled to educational benefits as ve or as widows or children of deceased or totally disabled veterans wit problems which may arise concerning their benefits. This Office also esses certification of enrollment and attendance to the Veterans Ad tration so that educational allowances will be paid.

When feasible, students entitled to benefits as veterans or depen of veterans should consult with the veterans counselor prior to subm application to the Veterans Administration. All such students shoul tain the instruction sheet issued by the veterans counselor which sets requirements to be fulfilled before certification of enrollment can be to the Veterans Administration and which includes other informati general interest.

The Veterans Administration is at 941 N. Capitol St., N.E., Washi D.C. 20421.

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e Washington University students may enroll in the Army ROTC am offered at Georgetown University, the AFROTC program at the rsity of Maryland, or the Army ROTC or AFROTC at Howard Uni- y. Those interested should contact the ROTC enrollment officer e of these universities. Credit for such courses may be transferable orge Washington University; prior approval is required by the dean school in which the student is enrolled.

DENT LIFE

President for Student and Alumni Affairs William Smith, Jr.
tant Vice President for Campus Life John Perkins

Office of the Vice President for Student and Alumni Affairs develops nt life services, policies, and procedures to complement the Uni- ty's formal instruction program. These activities are implemented gh the offices of the Cloyd Heck Marvin Center, Counseling Center, of Students, Educational Opportunity Program, Housing, International ces, Services for Students with Disabilities, Student Activities, Stu- and Alumni Career Services, and Student Health Service. The Office e Vice President for Student and Alumni Affairs is also responsible rograms and services for alumni through the Office of Alumni Rela- .

CE OF THE DEAN OF STUDENTS

of Students Gail Short Hanson
stant Dean of Students Cheryl Beil

Office of the Dean of Students provides counseling and information tudents, and assists in program development for the Division of Stu- Affairs. Staff members are well-informed on University policies and arious student services provided on campus, enabling them to provide rrals and answers to many questions concerning general student life. onal letters of recommendation for students applying to graduate professional schools can be obtained from this office. The Dean tudents is responsible for the services and programs offered by the nseling Center, Educational Opportunity Program, International Serv- Services for Students with Disabilities, Student Health Service, and Student and Alumni Career Services Office. The Dean of Student's e is located on the fourth floor of Rice Hall.

Counseling Center

Director E. Lakin Phillips
Assistant Director Diane DePalma

The Counseling Center works to enable students to overcome ob which hamper learning. The Center's services are offered to stude staff, and include (1) resolution of the individual's educational, voc or personal conflicts through short-term individual or group cou vocational testing, or study skills training; (2) training of g students, resident assistants, and paraprofessionals; (3) consult mental health topics; and (4) development of new methods and pr to aid student growth, such as counseling through written communi videotaped counselor skills training, and interpersonal skills work

The Center administers the Miller Analogies Test, admissions t and special assessments for business and industry. Through its Of Community Services, the Counseling Center also provides vocational seling and educational programs to the greater Washington commu

Students may request a cost-free interview from 9 a.m. to 4:30 Monday through Thursday, and from 1 to 4:30 p.m. on Fridays. student decides to continue, a modest fee per appointment will be ch for short-term treatment. If a test battery is called for, an addition materials fee will be charged. Fee adjustments can be made if fin need is a factor.

The Counseling Center is located at 718 21st St., N.W.

International Services Office

Director Patricia McMillen
Assistant Director Morris Jackson

Located in the International House at 2129 G St., N.W., the staff o International Services office provides advising and counseling in m of personal and academic concern and visa regulations. This office is a consultation, information, and resource center for the University ternational population.

Educational Opportunity Program

Director Ronald Whitmore
Assistant Director Marquita Green

The Educational Opportunity Program is designed to provide selected trict of Columbia high school graduates and other qualified District dents with financial and personal support as well as academic assistan help them pursue undergraduate degree work at George Washington versity. The Program office is located at 2127 G St., N.W.

Services for Students with Disabilities

Director Linda Donnels
Assistant to the Director Karen Franklin

The Office of Services for Students with Disabilities works to assure the special services necessary for handicapped students to participate

eir academic programs and the extracurricular life of the campus are ided for them through University or community resources. The office ated on the fourth floor of Rice Hall.

ent and Alumni Career Services Office

ctor Kathy Sims
stant Director Cynthia Gurne
nselor Barbara Fitzgerald-McClain

Career Services Office provides career guidance and placement as- nce to GW students and alumni. Some of the specific services are: ime and part-time job vacancy lists, career counseling, programs on seeking skills, a resource center of literature on occupations and em- ers, and current information on government employment including ng dates and application forms. Seniors and alumni may also use the e to establish credential files for application to graduate schools and employment. The office is located at Woodhull House, 2033 G St., N.W.

lent Health Service

ctor Mary Capon, M.D.

Student Health Service is an outpatient clinic located in the H.B. **s Memorial Building at 935 22nd St., N.W.**
he Health Service is staffed by physicians, nurse practitioners, and sician's assistants who are capable of addressing most of students' ical problems. Visits are cost-free and may be either arranged by ap- tment or, during certain hours, secured on a walk-in basis. Most ine laboratory tests may be performed in the Health Service lab at , many common medications are stocked to fill students' prescriptions, allergy shots and immunizations are administered by the staff nurse a minimal charge. A psychiatrist works in the Health Service to assist ents with mental health concerns.
or serious emergencies occurring during hours when the Student lth Service is closed, students may go to the Emergency Room of the versity Hospital for treatment. This arrangement is for emergency only, and all fees are the responsibility of the student.
udents must be currently enrolled on campus in the University to ive treatment at the Student Health Service. Students enrolled in campus programs and the Continuing Engineering Education Pro- n are not eligible. Students who so desire may engage physicians and es of their own choice, but these students will be responsible for all charged. The bills incurred from all services rendered outside of the lent Health Service (for example, x-ray work, laboratory work, and rrals to specialists or other outside physicians) are the responsibility he student.

LTH AND ACCIDENT INSURANCE

University has arranged for and endorsed group health and accident rance, on an elective basis, for those students who do not have other erage. Interested students should contact the Student Health Service ffice of the Dean of Students.

HOUSING

Director of Housing Ann Webster
Associate Director David McElveen
Assistant Directors Kathleen Jordan, Sherri McGee

Complete information concerning the University's residence halls is able from the Director of Housing, George Washington University, ington, D.C. 20052. Information concerning off-campus housing ne University also may be obtained at this Office.

Admission to the University does not include a room reservatio student will receive, with the notification of acceptance, Universit dence hall information, an application for residence hall space or ment accommodation, and a declaration of intent to attend the Univ The application for residence hall space or apartment accommo must be accompanied by a $200 *nonrefundable deposit*. The housi posit is credited toward the first semester's room or apartment c Rooms and apartments are leased for the academic year, and leas ment must be made in early June for the fall semester, unless the s elects the 10-month payment plan. Please check with the Stude counts Office for the latter option.

1982-83 Residence Hall Rates Per Person for Two Semesters*

For Men:

Calhoun Hall
double room .....
triple room .....

For Women:

Strong Hall
single room .....
double room .....
triple room .....

For Men and Women:

Crawford Hall
double room .....

Everglades Hall (limited to juniors and seniors)—
apartment for two persons .....2,110 o

Building JJ (limited to sophomores, juniors, and seniors)—
apartment for 4 or 6 persons .....

Francis Scott Key Hall (limited to juniors and seniors)—
apartment for two persons .....
apartment for three persons .....2,010 o

Madison Hall
double room .....
triple room .....

Milton Hall (limited to juniors and seniors)—
apartment for two persons .....2,110 o
apartment for three persons .....

* Residence hall prices and allocation are subject to change.

ell Hall
ngle room 1,970

on Hall (limited to juniors and seniors)—
partment for two persons ..... 2,110 or 2,010
partment for three persons 1,900

ton Hall
ouble room, triple room, room for four 1,820
uite for six 1,710

Service

lent freshmen and sophomores are required to choose one of the wing three food service plans: the seven-day, 19 meals per week at the rate of $1,550* for the academic year; the any 14 meals per plan for $1,480* for the academic year; or the any 10 meals per week at $1,420* for the academic year. Participation in the food service is optional for junior, senior, and graduate students, and for all stu- assigned to apartments. Food service payment does not cover ersity intersession or vacation periods. All meal cards admit bearer ning rooms in Thurston and Mitchell Halls and to the second-floor act dining room in the Cloyd Heck Marvin Center. Meal cards may be used on a cash-equivalency basis in the Marvin Center first-floor teria and Rathskeller.

dents who observe the Jewish dietary laws can write to make ar- ements with the George Washington University Housing Office re- ng the B'nai B'rith Hillel Foundation Kosher Meal Plan.

ridge Apartments

apartment house is a University-owned, commercially operated build- within the campus area. It contains efficiency and one-bedroom units h are rented only to full-time graduate students on an "as available" . Referrals to the resident manager of this building are made by the ctor of Housing when notice is received of vacancies. Leases are uted with the management company and are on a month-to-month s.

MNI RELATIONS OFFICE

ctor Sandra Hunter Lear

Alumni Relations Office, in conjunction with the General Alumni As- ation, makes available to alumni and their families an annual program ervices and educational and cultural events. Students are invited to icipate in the programs held on campus. In addition, the Alumni Rela- s Office sponsors or co-sponsors programs and services designed ifically for the student body.

lumni are encouraged to inquire about available services and programs he Alumni Relations Office, and to keep the Office informed of any nges in address or occupation.

he Alumni Relations Office is located in Alumni House, 714 21st St., ., George Washington University, Washington, D.C. 20052.

d service prices are subject to change.

CLOYD HECK MARVIN CENTER

Director Boris Bell
Assistant Director Donald Cotter

The Cloyd Heck Marvin Center serves as the campus community cen providing services, conveniences, and recreational and social opportuni for students, faculty, staff, alumni, and guests. Its wide range of facili provides the setting for a variety of programs conducted by the Univer Program Board; by the academic departments that include perform arts; and by other student and faculty organizations.

The Center Governing Board, representative of all segments of the U versity community, plays an important role in the functioning of Center by working closely with the full-time staff in the development procedures and policies which provide a framework for the Cent operation.

STUDENT ACTIVITIES OFFICE

Director Claudia Derricotte
Assistant Directors Michael Elmore, Randall Mason

The Student Activities Office assists individual students and organizatio in program development, campus leadership development, and participati in special projects, both within the University community and the co munity at large. The Office serves as a clearinghouse for activities info mation, registers and advises student organizations, and informs the Un versity community of activities and programs through monthly and annu publications. The Student Activities Office is also responsible for coord nating the orientation program for new students, and for planning suppl mental development programs for graduate and undergraduate student Students who want to participate in the extracurricular phases of Unive sity life should acquaint themselves with the facilities and staff of th Student Activities Office.

Additional information about the numerous student organizations a committees is contained in the *Student Handbook*, compiled by and ava able at the Student Activities Office in the Marvin Center.

Student Government

The George Washington University Student Association is comprised o all full-time and part-time graduate, professional, and undergraduate stu dents who are registered for academic credit on campus. A body of electe and appointed individuals is responsible for representing the interests o students at the University. The Student Association provides variou services for students such as an academic evaluation, a student directory and the Student Advocate Service. Further information can be obtaine from the Student Association offices in the Marvin Center.

Student involvement in the governance of the University is also possibl through participation in various administrative and Faculty Senate com mittees, advisory councils of the schools and colleges, selected committee of the Board of Trustees, and specialized bodies such as the Residence

all Association, the Joint Food Services Board, and the Marvin Center overning Board. This involvement has helped develop policies and programs beneficial to students and to the total University community.

tudent Organizations

tudents are encouraged to become involved with existing student organizations or to initiate their own. There are approximately 160 organiations on campus covering a broad spectrum of interests including acaemic, professional, international, cultural, political, service, sports, hobies, recreational, religious and meditative, as well as social fraternities nd sororities.

ELIGIOUS LIFE

he University recognizes the contribution that religion makes to the life f its students and encourages them to participate in the various religious rganizations of their own choice. Catholic, Jewish, and Protestant bodies ponsor various groups and form a link between the University and the eligious community. The advisors of the religious organizations are available for counseling. Religious services and special observances are also rovided for the University community as announced.

AJOR PROGRAM EVENTS

Art Exhibits—The work of locally, nationally, and internationally known artists is shown in monthly exhibits in the Dimock Gallery in Lisner Auditorium and in the art gallery of the Cloyd Heck Marvin Center. With the cooperation of the Curator of Art, an annual student art exhibit is presented.

Concert Series—The Department of Music presents a series of concerts featuring faculty, guest, and student artists throughout each year.

Dance—The GWU Dance Company presents major concerts, informal studio performances, experimental events, television appearances, and lecture-demonstrations. Students may audition to become company members and have the opportunity to choreograph, perform, and gain experience in the technical aspects of dance productions.

International Programs—The International Student Society presents an annual International Dinner in cooperation with foreign embassies and international restaurants. Other programs include regular forums and speakers on international topics.

Orchestra and Chorus Concert Series—The University Orchestra and Chorus are two facets of the lively arts available to students either as credit courses or as extracurricular activities. The Chorus presents major performances to the University community three or four times a year, including regular winter and spring concerts. The University Orchestra presents several performances annually.

Program Board—The University Program Board, composed chiefly of elected and appointed students, is given primary responsibility and resources for student programming on campus. Through its various committees, and in cooperation with other campus groups, it regularly sponsors films, lectures, concerts, social activities, and special events.

Theater—The University Theater produces four or five major plays musicals during the year on the proscenium/thrust stage in the Dor Betts Marvin Theatre or in Lisner Auditorium. Additional works, inclu original and experimental plays, are produced in a more intimate st theater. Students have the opportunity to participate in all aspect theater and may receive credit toward their B.A. or M.F.A. degrees some of their production work.

ATHLETICS, INTRAMURAL SPORTS, AND RECREATION

The Charles E. Smith Center for Physical Education and Athletics of many facilities for student use, including courts for basketball, volleyb and badminton; a jogging track; a swimming pool; wrestling, gymnas and weight rooms; handball and squash courts; and a sauna and lock Based in the Smith Center, the men's and women's athletic departme offer a broad program of intramural and recreational activities desig to accommodate various levels of skill, experience, and interest.

The University is a member of the National Collegiate Athletic Assoc tion, the Eastern College Athletic Conference, the Association for Int collegiate Athletics for Women and the Eastern Association of Int collegiate Athletics for Women. Its varsity teams compete against ma universities throughout the Midwest and Eastern Seaboard in such spo as basketball, baseball, soccer, tennis, golf, wrestling, crew, swimmi and diving, squash, badminton, volleyball, and gymnastics.

COLUMBIAN COLLEGE OF ARTS AND SCIENCES

Dean C.D. Linton
Associate Dean R.C. Rutledge
Assistant Deans R.E. Knowlton, G. Ludlow
Coordinator of Academic Advising B.P. Selinsky

FACULTY 1981-82*

Professors E. Abravanel, J.G. Allee, Jr., J. Aschheim, D.L. Atkins, R.L.A Bari, J.R. Barth, O. Bergmann, L.S. Bielski, L.S. Bowling, H.F. Bright, A.D Britt, R.G. Brown, J.F. Burks, W.E. Caldwell, E.A. Caress, A.J. Caron *(Re search)*, G.V. Carroll, I.H. Cisin, A.G. Coates, T.F. Courtless, Jr., R.H Davison, L.G. DePauw, R.M. Dunn, Jr., J. Eisenstein, N. Filipescu, R.S French, J.A. Frey, R.N. Ganz, Jr., J.L. Gastwirth, R.S. Goldfarb, M. Gor don, S.W. Greenhouse, F.S. Grubar, A. Gyorgy, S.E. Haber, M. Halperin *(Research)*, R.C. Haskett, P.H. Highfill, Jr., P.P. Hill, J.W. Hillis, A.J. Hilte beitel, H.C. Hinton, H.H. Hobbs, M.A. Holman, C. Hsieh, R.L. Humphrey.

* The President of the University, the Vice President for Academic Affairs, the Registrar of the University, the Director of Admissions of the University, and the University Librarian are *ex officio* members of the Faculty of Columbian College of Arts and Sciences.

Jr., R.G. Jones, H.D. Junghenn, I. Katz, J.W. Kendrick, R.W. Kenny, H. Kenyon, Y. Kim, J.C. King, A.D. Kirsch, P.F. Klarén, D. Krueger *(Research)*, R.M. Krulfeld, C.J. Lange, T.Z. Lavine, H.L. LeBlanc, P.H.M. Lengermann, S. Levitan, B.I. Levy, J.B. Levy, J.F. Lewis, R.K. Lewis, H.W. Lilliefors, R.C. Lindholm, C.D. Linton, T.P.G. Liverman, J.M. Logsdon, W.F.E. Long, J.C. Lowe, G.E. Mazzeo, M.L. Meltzer, B.M. Mergen, J.C. Miller, C.C. Mondale, J.A. Morgan, Jr., J.N. Mosél, C.A. Moser, N.N. Natov, D. Nelson, B. Nimer, R.K. Packer, R. Parris, T.P. Perros, E.L. Phillips, F. Prats, R.E. Purcell, J.P. Reesing, Jr., B. Reich, W.M. Reynolds, C.E. Rice, J.W. Robb, L.F. Robinson, L.A. Rothblat, D.A. Rowley, H.M. Sachar, B.M. Sapin, S.O. Schiff, R.H. Schlagel, F. Schmidt *(Research)*, W.E. Schmidt, L.G. Schwoerer, R.P. Sharkey, C. Shih, F.R. Siegel, D.E. Silber, N.D. Singpurwalla *(Research)*, R.T. Smythe, H. Solomon, C. Steiner, G. Steiner, R.W. Stephens, C.T. Stewart, Jr., P.L. Stewart, T. Suranyi-Unger, Jr. *(Research)*, C. Taam, D.H. Teller, K. Thoenelt, R. Thornton, C.M. Turnbull, R.D. Walk, R.H. Walker, Jr., D.D. Wallace, Jr., R.A. Wallace, S.J. Wayne, L. Wei, D.G. White, H.B. Yakobson, H.E. Yeide, Jr., A.J. Zuchelli

Associate Professors A.D. Andrews, I. Azar, L.W. Banner *(Visiting)*, S.R. Barnett, W.H. Becker *(Visiting)*, B.L. Boulier, G.R. Bozzini, L. Brandt, M.D.M. Brewer, A.S. Brooks, A.E. Claeyssens, Jr., M.A.B. Coffland, J.J. Cordes, C.F. Elliott, E.A. Fisher, A.K. Fitzsimmons, H.I. Gates, H.F. Gillette, Jr., I.I. Glick, V.K. Golla, M.D. Green, S.K. Green, W.B. Griffith, M.M. Gupta, R.A. Hadley, E.P. Harper, O. Havrylyshyn, D.R.K. Henney, C.J. Herber, D.M. Hitchcock, R.W. Holmstrom, J.O. Horton, T.L. Hufford, W.R. Johnson, S.A. Karp, R.E. Kennedy, Jr., N.K. Khatcheressian, M. King, R.E. Knowlton, J.E. Kwoka, Jr., J.M. Lachin III *(Research)*, J.L. Lake, M.P. Lee, D.R. Lehman, C.A. Linden, C.W. Linebaugh, G. Ludlow, J.H. Maddox, H. Merchant, H.R. Nau, G.A. Olkhovsky, T. Ozdogan, W.C. Parke, J.N. Pearce, E.O. Pederson, J. Pelzman, J.A.A. Plotz, P.J. Poppen, J.A. Quitslund, D.E. Ramaker, J.R. Regnell, L.P. Ribuffo, P. Robbins, W.W. Rowe, R.C. Rutledge, P.G. Sáenz, R.M. Scheffler, R.P. Seifert, S.L. Simons, A.H. Smith, C.W. Sten, E.A. Stone, R.H. Tanck *(Research)*, M.F. Taragin, J.E. Thiel, R.E. Thomas, I. Thompson, N.A. Tilkens, J.L. Tropea, R.P. Trost, C.E. Tuthill, J.M. Vlach, R.C. Willson, J.F. Wright Jr., **A.M. Yezer, R.Y. Yin, J.E. Ziolkowski**

Adjunct Associate Professors L.J. Lear, A.L.K. Nelson

Assistant Professors C.J. Allen, D.A. Altshuler, J.C. Anderson, W.A. Anderson, M.A. Atkin, D.A. Bositis, A.R. Bruhn, J.R. Burns, G. Carter, R.P. Churchill, R.L. Combs, C.C. Costigan, M.S. Cruz-Sáenz, C.J. Deering, T. Dietz, R.P. Donaldson, M.V. Dow, H.B. Feigenbaum, V. Fon, R.S. Frey, N.C. Garner, F. Griffith, R.J. Guenther, S. Hashtroudi, J.R. Henig, J.E. Hicks, G.P. Huvé, L.B. Jacobson, D.E. Johnson, C.C. Joyner, S. Keller, M.P. Lader, D.L. Lee, S.R. Lichter, J.P. Link, M.L. Marlow, D. McAleavey, C. McClintock, R.D. McDevitt *(Visiting)*, A.L. Mescher, M.R. Metzger, M.F. Miller, S.B. Molina, A. Montaser, J.D. Moreno, L.R. Offermann, P.M. Palmer, G. Paster, J.R. Peverley, D. Pollock *(Visiting)*, W.A. Pucilowsky, S.A. Quitslund, R.M. Robin *(Visiting)*, A. Romines, B.W. Sabelli, O.A. Seavey, M.S. Shapiro, S.S. Smith, M.J. Sodaro, J.L. Stephanic *(Visiting)*, G.C. Stephens, P.F. Thall, J.M. Thibault, M.A.

Ticktin, A. Viterito, B. Von Barghahn, A.G. Wade, G.C.Y. Wang,
Watson, E.F. Wells, B.R. Williams, E.R. Williams, S.L. Wolchik,
Woodward, G.E. Wright
Instructor J.S. Varden

Committees*

DEAN'S COUNCIL FOR FRESHMAN AND SOPHOMORE AFFAIRS
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1983: J.O. Horton, J.F. Wright, Jr.
1984: M.D.M. Brewer, D.E. Silber

DEAN'S COUNCIL FOR JUNIOR AND SENIOR AFFAIRS
1982: C. McClintock, R. Willson
1983: S.R. Barnett, L.J. Wei
1984: E.P. Harper, J.R. Regnell

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T.P. Perros *(Chairman)*, M.D. Green, R. Hadley, G. Ludlow, C.E. Ri
L.F. Robinson, R. Walker

COMMITTEE ON SCHOLARSHIP
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Selinsky, R.A. Wallace

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Churchill, R.L. Combs, R.S. Frey, R.E. Knowlton, S.A. Quitslund, R.
Rutledge, W.E. Schmidt, E.A. Stone, K. Thoenelt

COMMITTEE ON USE OF CORRECT ENGLISH
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Moser, R.C. Willson

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1984: T.L. Hufford, J.N. Mosél, C.A. Moser, J.A. Quitslund

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CONTINUING EDUCATION AND SUMMER SESSIONS
R.C. Rutledge *(Chairman)*, D.L. Atkins, F.S. Grubar, C.J. Herber, M.A
Holman, D. Nelson, D.G. White

Council of Arts and Sciences†

Mark Sullivan, Jr. *(Chairman) (University Trustee), Thomson & McKinnon*
Auchincloss Inc., Washington, D.C.

* The Dean of Columbian College is an *ex officio* member of all committees; all listed committee members are elected by the Faculty of Columbian College.
† This Council serves both Columbian College of Arts and Sciences and the Graduate School of Arts and Sciences. The President of the University, the Vice President for Academic Affairs, the Dean of Columbian College of Arts and Sciences, and the Dean of the Graduate School of Arts and Sciences are *ex officio* members of the Council.

ndsor P. Booth, *Chief of the News Service, National Geographic Society*
vid Edward Finley *(Retired Director of the National Gallery of Art), Washington, D.C.*
bert R. Garvey, Jr., *Executive Secretary, Advisory Council on Historic Preservation, Washington, D.C.*
trick Hayes, *Managing Director of the Washington Performing Arts Society, Washington, D.C.*
n Ross Howard, *Office of Public Affairs, Aerospace Industries, Washington, D.C.*
remiah Milbank, Jr. *(University Trustee), New York, N.Y.*
hn Palmer Reesing, Jr., *Professor of English*
dney Dillon Ripley II *(University Trustee), Secretary, Smithsonian Institution*
bert Poindexter Sharkey, *Professor of Economic History*
lian H. Singman, *Attorney, Washington, D.C.*
uis B. Wright, formerly *Director, Folger Shakespeare Library*

NTRODUCTION

ince its founding in 1821, Columbian College of Arts and Sciences, the beral arts college of the University, has continued to expand and develop ith the city of Washington. Its central situation makes participation in e life of the nation's capital convenient for resident students. The cosnopolitan nature of the student body reflects the atmosphere of a great orld capital. Because the students come from the 50 states and from 20 foreign countries, class discussions and casual student conversations re enriched by a challenging variety of viewpoints.

The Columbian College program is a contemporary application of the istoric liberal arts tradition. Its purpose is to enable the student to develop both particular abilities and general awareness as a human being. t demands of the student a thorough acquaintance with one major area f learning and at the same time an understanding of how that specialization fits into the larger context of the scientific, social, and moral problems which confront modern society. It stresses a broadly enlightened perspective which encourages its graduates to grow through the years in ability and wisdom.

Throughout its history, the College has kept pace with, and often led, movements of reform in higher education. Sensitive to the rapidly changing patterns of student and social needs, notably the increasing maturity and knowledge of the modern incoming freshman, the College has from time to time inaugurated major changes in its academic programs. In brief summary, present patterns are designed to (1) permit the able student to earn the baccalaureate degree in less than the standard four years, either by earning credit through a wide variety of examinations or by performing with excellence within a 90-semester-hour three-year program; (2) provide each student with a greater opportunity to design an individual academic program by eliminating almost all specific course requirements except in the major field; (3) encourage an early and close association between the student and individual faculty members in the field of the student's chief interest; and (4) foster a spirit of community and shared responsibility between faculty and student.

Opportunities exist for double majors (and minors) within the Col interdisciplinary programs; and, in the case of the student who find existing major or program suitable to individual educational goals, sp interdisciplinary programs which may be developed by the student, in sultation with departmental advisors and with the final approval of Committee on Curriculum.

Columbian College offers programs leading to the degrees of Asso in Arts, Bachelor of Arts, Bachelor of Science, and Bachelor of Music; legal and pre-medical programs; and the first two years of the professi programs in public and international affairs.

Columbian College has degree-granting authority over certain progr which combine on-campus and off-campus courses. These include Bachelor of Science degrees in Geodesy and Cartographic Science. most of the courses in the first two years of these programs are offe on campus, students may be admitted as full-time on-campus stud in Columbian College. After the first 64 hours, most of the courses offered at off-campus locations. Students are then required to regi for their course work with the Division of Continuing Education and Su mer Sessions, which administers off-campus programs. Students attend off-campus classes are expected to provide their own transportation to from class. Distances involved vary from two to 20 miles from the cam area. Columbian College also has degree-granting authority over two ot programs which are usually offered off campus and administered by Division of Continuing Education and Summer Sessions: Associate in A in General Studies and Bachelor of General Studies (areas of concentrati in economics, history, mathematics, political science, psychology, sociology). For further information on all these programs, consult Division of Continuing Education and Summer Sessions.

ENTRANCE REQUIREMENTS

Good character and an academic background appropriate for the progr of studies contemplated are required.

Requirements for admission to the freshman class are as follows:

1. An acceptable certificate of graduation from an accredited seconda school, showing at least 15 units* which must include four years of En lish; at least two years of one foreign language; two years of scienc preferably with laboratory instruction; two years of social studies, one which must be American history; and one year of college preparato mathematics beyond introductory algebra.

2. The principal's statement that the applicant is prepared to undertak college work.

3. College Entrance Examination Board scores submitted on the Scho lastic Aptitude Test.

4. Admission to the Bachelor of Music curriculum requires, in additio to the above, a performance audition (a tape is acceptable) and/or musi testing.

It is recommended that the examinations be taken in December o January. Scores on tests taken in the junior year may be submitted. Ap

* A unit represents a year's study in a secondary school subject, including in the aggrega not less than 120 sixty-minute periods, or the equivalent, of prepared classroom work.

ngements for tests are the responsibility of the applicant and should be ade with the Educational Testing Service, Princeton, N.J. 08540; or 1947 enter Street, Berkeley, Calif. 94704, not less than one month before the ate of the test. In applying for the test, the applicant should specify that e scores be sent to the Office of Admissions, George Washington Uniersity, Washington, D.C. 20052.

The College Entrance Examination Board tests are preferred; however, he American College Testing battery scores will be accepted. The applicant should request that these scores be sent to the Office of Admissions irectly from the American College Testing Program, Iowa City, Iowa. It s recommended that the applicant take the tests in October of the senior ear.

The Committee on Admission and Advanced Standing will consider he adequacy of the qualifications of an applicant who, because of unusual ircumstances, does not present all of the formal requirements stated here. he Committee may prescribe appropriate scholastic-aptitude tests of the niversity. Students admitted with deficiencies in secondary school nits will be required to begin removing such deficiencies within the first ear, by appropriate courses or examinations. Courses taken to clear ntrance deficiencies will not fulfill Columbian College meaningful initiaion requirements as set forth on page 72, or distribution requirenents prescribed by the School of Public and International Affairs.

EGULATIONS

Regulations regarding admission, registration, fees and finances are stated on pages 19-32; other University regulations, on pages 44-52.

SCHOLARSHIP REQUIREMENTS

ACADEMIC WORK LOAD

To encourage academic performance of high quality, the College limits the student's work load.

A full-time student not on probation may take a course load of as much as 17 semester hours. A student employed more than 20 hours a week who is not on probation may take not more than 10 hours.

The amount of work taken by a student on probation may be limited by the Committee on Scholarship.

A full-time student who, during the immediately preceding semester, has received no grades below *B* and has earned grades of *A* in three courses totaling at least nine semester hours may take 18 or 19 hours. An employed student who, during the immediately preceding semester, has received no grades below *B* and has earned grades of *A* in two courses totaling at least six semester hours may take 12 hours.

A student who accepts employment after registration or at any time during a semester must report that fact immediately to the dean so that the academic program may be adjusted, if necessary.

ATTENDANCE

The student is held responsible for all the work of the course in which registered, and all absences must be excused by the instructor in charge before provision is made for the student to make up work missed.

ADDING AND DROPPING COURSES

After registering, a student may add or drop courses only by means
official "drop-add" form available in the Office of Columbian Co
Failure to drop a course may result in a failing grade. The deadline for
ing a course during the regular fall or spring semesters is the end o
first week of classes. However, if the student presents a note from th
structor explaining the special circumstances, and granting permissi
course may be added up to the end of the second week of classes.

The deadline for dropping a course without academic penalty is the
of the fourth week of classes in the fall and spring semesters. The d
line for complete withdrawal from all courses without academic pen
is the end of the ninth week of classes. After the deadlines, prog
changes require that the student present a petition to the Dean's Counc

USE OF CORRECT ENGLISH

The use of correct English, oral and written, is required in all cour
Any student whose English in any course whatever is deemed unsa
factory may be reported by the instructor to the dean and to the C
mittee on the Use of Correct English. The chairman of the Committee r
assign supplementary work, without academic credit, varying in amo
with the needs of the student. If the work prescribed is equivalent t
course, the regular tuition fee is charged. The granting of a degree m
be delayed by failure to make up any such deficiency in English to
satisfaction of the Committee and the dean.

DEAN'S LIST

The name of every student who takes a minimum of 15 semester hou
(none of which may be in pass/no pass courses) in any one semest
who receives grades of *A* in at least 60 per cent of the course work tak
in that semester, and who has no grades below *B* for that semester,
placed on the Dean's List for that semester.

ACADEMIC STANDING

A student who is not suspended or on probation is considered to be
good standing.

The following rules governing probation and suspension are applicab
as stated to students enrolled for a full-time program (12 semester hou
or more) during the fall or spring semester. Students enrolled for less th
12 semester hours during the fall or spring semester and students enroll
during the summer sessions are subject to probation or suspension on t
basis of their record for four courses (three or more semester hours
credit each), or multiples thereof, rather than on their record in any o
semester.

Probation—A student who in one semester receives two failing grad
(*F* or *Z*) in courses carrying three or more semester hours of credit each,
the equivalent, is placed on probation. A student in the first semester
probation who receives one failing grade in such a course will be co
tinued on probation for a second semester. Two grades of *D* will be treat
as equivalent to one grade of *F* in determining probation. Any grades of
or *F* replacing earlier grades of *I* will be considered a part of the record f
the semester during which the *I* is removed. A student on probation takin

2 or more semester hours whose grades are all *C* or better is removed from probation.

Suspension—The following cases constitute grounds for suspension: (1) three failing grades (*F* or Z) in courses carrying three or more semester hours of credit, or the equivalent, in one semester; (2) two failing grades in such courses in the first semester on probation; (3) one failing grade in such courses in any later semester on probation. Two grades of *D* will be treated as equivalent to one grade of *F* in determining suspension. Any grades of *D* or *F* replacing earlier grades of *I* will be considered a part of the record for the semester during which the *I* is removed.

The minimum period of academic suspension is one fall or one spring semester. Final dates for applying for readmission are the same as those governing undergraduate admission (see page 20). A suspended student seeking readmission must submit evidence to the Committee on Admission and Advanced Standing of conduct during absence from the University which indicates that the student will profit from readmission. A student suspended twice for poor scholarship will not be readmitted.

Mid-semester Warning—When, at the end of the eighth week of each semester, instructors file in the Office of the Dean the names of freshman and sophomore students who are doing unsatisfactory work, a notice of warning is sent to the student and a copy filed with the appropriate advisor. A warning constitutes notice to the student to consult the instructor and advisor at the earliest opportunity.

INCOMPLETE/AUTHORIZED WITHDRAWAL

Conditions under which the grades of *I* (Incomplete) or *W* (Authorized Withdrawal) may be assigned are described on page 45.

Removing an Incomplete—The grade of *I* must be removed no later than the last day of the examination period for the fall or spring semester immediately following the semester or summer session in which the grade of *I* is assigned. An "Incomplete" that is not removed within this period is automatically changed to an *F*. In cases of well-documented extenuating circumstances, an instructor and a student may jointly petition the dean, or the appropriate committee, for additional time in which to complete the work of the course. Such petitions should be submitted within the same period. The grade of *I* cannot be removed by reregistering for the course here, or by taking its equivalent elsewhere.

CORRESPONDENCE AND HOME-STUDY COURSES

No credit is given for work done by correspondence or in home-study courses.

CLASSIFICATION OF STUDENTS

A student becomes a *sophomore* upon completion of 30 semester hours, a *junior* upon completion of 60 semester hours, and a *senior* upon completion of 90 semester hours.

An *unclassified* student is one who is not a candidate for a bachelor's degree (normally because the student already holds one), but who wishes for valid academic reason to take a limited program for a limited time. Registration in this status is permitted only with the prior approval of the appropriate Dean's Council.

STUDY IN PARIS PROGRAM

Students in good academic standing, who will be sophomores or juni at their proposed time of study abroad, may be eligible to participate in George Washington University–American College in Paris Study in P Program, either for an academic year or for a spring semester. Qualif students will be encouraged to take this opportunity to profit from cultural and intellectual riches of Europe by spending a period of t living and studying in Paris. Credits earned with acceptable grades will transferable toward the appropriate degree in Columbian College of A and Sciences, subject to prior approval by the Study-Abroad Advisor Columbian College. A knowledge of French is desirable but not mand tory, as all courses, except foreign languages and literatures, are tau in English. More information on the Paris program, and on other stu abroad programs, may be secured from Assistant Dean Ludlow at Office of Columbian College.

INACTIVE STATUS

Students in Columbian College who wish to interrupt their studies m apply to the dean for Inactive Status. They may apply at any time befo the close of the registration period of the first semester for which t status is desired. If approved, Inactive Status (for which no fee is charge assures the student for a period of one calendar year that re-entrance the College may take place under regulations prevailing at the time last registration. After the expiration of one calendar year of Inacti Status, or if the student has attended any other college or university d ing absence from this University (but see below), the student must foll regular readmission procedures and resume studies, if readmitted, und regulations then current.

Students who wish to attend another college or university, in t country or abroad, during the period of Inactive Status may, by prior pe tion to the dean, request approval of the planned program and, if approv is given, be assured of re-entry within one year under regulations pr vailing at the time of last registration here.

LEAVE OF ABSENCE—See pages 46-49.

ADVISORY SYSTEM

Each student is provided with both academic advising and personal cou seling. *Academic* advising is performed by members of the faculty selecte for their knowledge of academic programs, and each student, before reg tration, makes up a program in consultation with the advisor assigned. student who has *not* selected a major field receives academic advisi from a member of the Columbian College Committee on Student Advisi (see page 64). A student who has officially declared a major field receiv academic advising from the appropriate department, or from an inte departmental committee. *Personal* counseling is available through t Office of the Dean of Students or through the University Counseling Cente All students are encouraged to maintain close contact with their advisor Advisors' office hours are posted in the College office.

Students who intend to transfer after the sophomore year to the School f Public and International Affairs are assigned special advisors to assist hem in planning their programs.

An academic warning system permits early attention to students whose ork falls below required standards. In such cases, students are asked p consult regularly with their advisors. On request, and with the student's ermission, copies of academic warnings or probation notices may be sent p parents or guardians, who are themselves welcome to meet with mem- ers of the advisory staff.

CADEMIC ADVISING CENTERS

ach department has set up Academic Advising Centers where both gen- ral educational counseling and specific major-field advising are available o students. The locations and hours of these Centers may be obtained rom departmental offices.

As the freshman student deliberates choice of a major, he or she should consult with faculty advisors in as many of these Centers as he or she wishes. Once a major is officially declared, the student then receives all academic counseling from the Academic Advising Center of the major department.

EER ADVISING

o supplement academic advising by faculty members in Columbian Col- ege, peer advising is also available during fall and spring registration and he Summer Advance Registration Program. Undergraduate peer advisors, epresenting a broad range of major fields, are centrally located to offer cheduling help and course selection advice to fellow students. Peer advisors are available to provide assistance throughout the academic year. A roster of current advisors is published following each registration period.

DECLARATION OF MAJOR

The student is encouraged to select and officially declare a major field early, normally no later than the end of the freshman year. All students, however, whether they are entering freshmen or transfer students, must secure the advisor's signature on a proper form (obtainable in the Office of Columbian College), and return the form to the Office of Columbian College in order to declare a major. No student is considered to have a major until this process is completed. Thereafter, the student receives academic guidance from a faculty advisor in the major-field department.

In most cases, filing of the approved declaration form assures the student of admission to the major declared; however, if space, equipment, or other requirements compel a department or major program to limit the number of students in that major, admission to the major may be on a selective or space-available basis.

COLUMBIAN COLLEGE GENERAL COURSE REQUIREMENTS

All candidates for the degree of Bachelor of Arts or Bachelor of Science are admitted to a general arts and sciences curriculum until they declare

a major field. Except for two general course requirements, all curricul requirements leading to the degrees of Bachelor of Arts and Bachelor Science are established by the various major field departments or p grams. Bachelor of Music candidates are admitted directly into the partmental curriculum.

The two general requirements are the following:

1. Each student must, during the freshman year, demonstrate adequ achievement in English Composition, either by examination or by taki Engl 9 or 10, and Engl 11 or 12. This requirement may not be postpon

2. Each student at some point in the college career must undertake meaningful initiation into the three divisions of knowledge: humaniti natural and mathematical sciences, and social sciences. As each maj field will normally represent one of these three areas, the requirement m be fulfilled by taking no less than 12 semester hours in each of t other two areas. The requirement for each division must be fulfilled with two departments, or in specially designed interdisciplinary courses. (Ca didates for the Bachelor of Music degree are subject to the requiremen found on pages 386-87.) The 12 credits may be in approved introducto courses or in approved advanced courses if the student is qualified a receives the instructor's permission. Courses taken to clear entrance d ficiencies do not satisfy meaningful initiation requirements. Applied a tool courses do not satisfy the requirement for meaningful initiation in the humanities. All science courses taken in fulfillment of the meaningf initiation requirement must include laboratory instruction. Waived cours (no credit assigned) cannot satisfy the meaningful initiation requirement

It is recommended that courses taken to satisfy the meaningful initiatio requirement be selected from the following:

Humanities

Art 31-32, 71-72; Classical languages 71, 72, 108, 113; Chinese 163-164; Engli 51-52, 61-62, 71-72, 191-192; French 51-52, 60, 91-92; German 51-52, 103-10 Music 3-4; Philosophy 50 and 71, 111, 112, 113, 131, 132, 151, 152, 162, or 172; R ligion 9-10, 59-60, 21-22, or 23 and 9; Slavic languages 71, 91-92; Spanish 51-5 91-92; Speech and Drama 45, 49, 133, 143, 144, 165, 166, 173, 192.

Natural and Mathematical Sciences

Biology 3-4, 11-12; Chemistry 3-4, 11-12; Geology 1-2, 5 and 2, or 5 and 10 Mathematics 31-32, 32-33, 41-42, 51-52, 53-54, 9-10, or any combination of tw upper-level math courses; Physics 1-2, 9-10; Statistics 51 and 97 or 105, 53 an 97 or 105, 91 and 97, or 111-12.

Social Sciences

American Civilization 71-72; Anthropology 1-2; Economics 1-2; Geograph 1-2; History 71-72, 39-40, 72 and 91, 40 and 91, one introductory course and related 100-level course approved by the History Department, or (for thos students who have waived introductory courses) two sequential 100-leve courses approved by the History Department chairman or advisor; Journalis 71-72, 111 and 115; Political Science 1-2; Psychology 1 and 5, 6, 8, 22, or 2 Sociology 1-2 or Sociology 1 and any 100-level sociology course.

The following courses will not satisfy the meaningful initiation requirement Applied courses in art (also Art 1); applied courses in music and in speech an drama (SpDr 1 and 11); English composition courses; basic (first- and second year) foreign language courses; Math 3, 6, 30.

Required Placement Examinations

English—Students whose scores on either the Test of Standard Written English or on the English Composition Achievement Test suggest that they will benefit from more intensive training in compositional skills may be assigned to Engl 9 or may be tested in vocabulary, spelling, grammar, standard usage, and writing skill before placement in either Engl 9 or 10. Students whose scores indicate superior competence will be allowed to waive the Engl 10 requirement.

English for International Students—see pages 25-26.

Foreign Languages—A student who has not been granted advanced standing and who wishes to continue in college the language begun in high school must take a placement examination in one of the following: Chinese, French, German, Greek, Hebrew, Italian, Latin, Russian, or Spanish. Upon completion of the examination, assignment is made to the appropriate course.

Mathematics—New students who wish to register in Math 30, 31, or 41 are required, prior to registration, to take a placement examination in algebra and trigonometry; those wishing to register in Math 51 are required, prior to registration, to take a placement examination in algebra.

Foreign Language Requirement

In most major programs requiring foreign languages a student must complete satisfactorily the equivalent of two years of college work in a single foreign language.

A student offering for admission four acceptable high school units of a single foreign language, or the equivalent, is not required to take any foreign language.

A student who offers less than four units and wishes to continue the same language must take the language placement test.

In many instances foreign languages are required or recommended as preparation for advanced work. The student should consult the advisor so that appropriate foreign languages may be included, when necessary, in the student's program.

First- and Second-Group Courses

First-group courses, those numbered from 1 to 100, are intended primarily for freshmen and sophomores. Second-group courses, those numbered from 101 to 200, are intended for juniors and seniors. However, a qualified freshman or sophomore may, with the permission of the advisor and of the department concerned, take second-group courses. Such qualification is achieved by passing or waiving introductory courses or prerequisite courses in the first group.

Courses in the Major Field or Department

Every student is given the opportunity of taking a wide range of liberal arts subjects—humanities, natural and mathematical sciences, social sciences—both as a means of laying the groundwork for more concentrated major-field study and as a means of determining what academic

area is best adapted to the student's interests and aptitudes. In order t enhance this opportunity and to avoid over-specialization once a majo has been selected, the student must take at least 60 hours of course wor including the general course requirements of Columbian College, outsid the major-field department or major program. (This does not apply t students in the 90-hour degree program or the Bachelor of Music pro gram.)

Professional Courses

Except for majors in applied mathematics and for students interested i teacher certification or intending to apply for the combined degree o Bachelor of Arts and Doctor of Medicine, no more than 12 hours of pro fessional courses, e.g., courses offered in units of the University other tha Columbian College, may be included in the hours required for the bache lor's degrees in Columbian College. Students electing professional course under this rule must obtain the approval of the dean before registration

Human Kinetics and Leisure Studies

Courses in Human Kinetics and Leisure Studies are not required, no are such courses generally acceptable for credit toward a degree. Upo prior petition to the dean, however, certain courses in dance as an ar form may be included in the 12 hours of professional credit permitted.

Experimental Humanities/Service-Learning Program

A maximum of 21 semester hours in any combination of Experimental Humanities courses and Service-Learning Program courses may be credited toward bachelor's degrees in Columbian College.

Earning Credit By Examination

Assuming there is no duplication of course work earned, a maximum of 30 semester hours of credit may be assigned for any combination of the following:

College Entrance Examination Board Advanced Placement Tests—Credit may be granted for college-level courses taken in an approved secondary school if substantiated by satisfactory performance on the Advanced Placement Tests. See page 23 for further details.

College Entrance Examination Board College-Level Examination Program (CLEP)—Prior to matriculation, credit may be assigned for CLEP General Examinations passed at the 50th percentile or above. Credit may be assigned for any CLEP Subject Examinations passed at the level recommended in the College Board model policy. A few examinations in both categories, however, are unacceptable for credit. See page 22 for specific exceptions.

After matriculation, credit for CLEP Subject Examinations will not be assigned without special authorization by the Columbian College department governing the subject involved. See page 22 for additional information.

Special Departmental Examinations—A student may request any department of Columbian College to offer a special examination covering the subject matter of any specific course. (If an appropriate CLEP Subject Examination is available, the department may choose to employ it.) Approval of such a request is not automatically granted; the student must offer evidence of sufficient background to have a reasonable command of the subject matter. A student who has previously taken examinations to waive course requirements may not subsequently take examinations for credit in the same courses. Assigning credit (or waiving a requirement) by special departmental examinations will depend on the department's evaluation of the examination paper. These examinations will normally be of at least three hours' duration. A fee of $25 for each course examination is charged for preparation, administration, and grading of the examination.

Waiving Introductory Courses by Examination

Placement Tests—Many departments in Columbian College, including English, mathematics and all foreign languages, require students to take placement tests to determine level of proficiency or eligibility for specified courses. The student is placed in an appropriate course on the basis of these tests. There is no charge to the student for placement tests, and no credit (advanced standing) is awarded for courses bypassed or waived as a result of these tests.

Waiver Examinations—Several departments in Columbian College, including English, history and sociology, offer periodic waiver examinations for introductory courses. Such examinations may be attempted at the option of the student; a fee of $5 is charged. Specific departments should be consulted for further details. *Passing a waiver examination does not entitle a student to any semester hours of credit.*

Earning Additional Semester Hour of Credit

Normally, no deviation is permitted from the number of semester hours of credit given in parentheses after the title of each course. In exceptional circumstances, however, and with the prior approval in writing of the instructor and the dean, a student may register for and earn an additional semester hour of credit in certain appropriate second-group (upper-division) courses by doing a significant amount of extra work as assigned and supervised by the instructor. This privilege is not applicable during the Summer Sessions.

PREPROFESSIONAL REQUIREMENTS

Students who plan to major in any program offered by the School of Public and International Affairs are registered during the freshman and sophomore years in Columbian College. Requirements for the first two years of these programs, as well as requirements for the premedical program, are listed on the following pages.

Premedical Curriculum

A premedical student who intends to work toward a bachelor's degree fulfills the general requirements of Columbian College (see pages 71-72),

and may follow the major field curricula of any Columbian Colle department. Each premedical program must be approved by the pr medical advisor. For admission to most medical schools the student mu have a minimum of 90 semester hours applicable towards a degree in approved college of arts and sciences; the 90 hours must include

1. *Biology:* eight semester hours. This may be either in general biology zoology but may not include separately credited courses in botany.
2. *Chemistry:* eight semester hours of general inorganic chemistry (whi may include qualitative analysis), including four semester hours of laborator and six to eight semester hours of organic chemistry, including laboratory.
3. *Physics:* eight semester hours, including at least two semester hours laboratory.
4. *English:* six semester hours. This may be the usual introductory colle course or its equivalent.

Many medical schools have additional entrance requirements, amon which are courses in biochemistry, embryology, histology, genetics, an mathematics. Even where such courses are not actually required, they ar strongly recommended.

With the exception of these specific requirements applicants are urge to follow their personal interests in developing their premedical course of study. A well-balanced program, rather than a specific field, is th criterion by which an applicant is judged. It is not advisable to tak courses that appear to cover subject matter in the medical program.

While well-qualified candidates are eligible for admission after com pleting the minimum 90 semester-hour requirement, the majority of appli cants are found to be better prepared for the study of medicine after fou years of college work.

Preparation for Law School

The best undergraduate preparation for law school is a solid, broad liberal education. Columbian College, therefore, does not prescribe a "pr legal" curriculum. One of the Assistant Deans in the College, however, i designated as Pre-Law Advisor, and students interested in legal studie should consult him for information and guidance.

Chinese Language and Literature

The first two years in preparation for the Bachelor of Arts degree with a major in Chinese Language and Literature in the School of Public and International Affairs consists of a minimum of 60 semester hours. Each student must, during the freshman year, demonstrate adequate achieve ment in English Composition, either by examination or by taking Engl 9 or 10, and Engl 11 or 12. The student must also undertake a meaningfu initiation into the three divisions of knowledge: humanities, natural and mathematical sciences, and social sciences. As the major field represents one of these three areas, the requirement may be fulfilled by taking no less than six semester hours of approved introductory courses, or six semester hours in approved advanced courses if the student is qualified and receives the instructor's permission, in the natural and mathematica sciences and in social sciences. Students must include in their program of study Chin 1-2, 3-4, and 9; Chin 7-8 and 9; or Chin 5-6. Chin 5-6 is preferred.

East Asian Studies, Middle Eastern Studies, or International Affairs Curriculum

First two years in preparation for the Bachelor of Arts degree in the field of East Asian Studies (China or Japan), Middle Eastern Studies, or International Affairs in the School of Public and International Affairs:

		Semester Hours
English:	Engl 9 or 10, and 11 or 12	6
Humanities or AmCv:	Art 31–32 or 71–72; *Literature (American, Chinese, East Asian, English, French, German, Greek and Latin, Italian, Slavic, or Spanish); Mus 3, 4; first- or second-group philosophy courses; Rel 21, 59–60; or AmCv 71–72	6
†Language:	Chinese, Japanese, French, German, Hebrew, Italian, Russian, or Spanish	12–16
Math/Science:	BiSc 3–4 or 11–12; Chem 3–4 or 11–12; Geol 1–2; Math 9 and 10 or 30 and 31; Phys 1 and 2 or 9–10; or one course selected from Stat 51, 53, 91, 111, and one course selected from Stat 97, 105, 112	6–8
Social Science:	Econ 1–2; Hist 40 and 72; PSc 1, 2, and 91§	21
‡Elective:		3-9
	Total	60

Public Affairs Curriculum

First two years in preparation for the Bachelor of Arts degree in the field of Public Affairs in the School of Public and International Affairs:

English:	Engl 9 or 10, and 11 or 12	6
Humanities or AmCv:	Art 31–32 or 71–72; *Literature (American, Chinese, English, French, German, Greek and Latin, Italian, Slavic, or Spanish); Mus 3, 4; first- or second-group Philosophy courses; Rel 21, 59–60; AmCv 71–72	6
Language or Statistics:	NOTE: This requirement may be satisfied by two years of one foreign language† or 12 semester hours of statistics. Statistics courses taken to fulfill this requirement may not also satisfy the math/science requirement below.	12
Math/Science:	BiSc 3–4 or 11–12; Chem 3–4 or 11–12; Geol 1–2; Math 9 and 10 or 30 and 31; Phys 1 and 2 or 9–10; or one course selected from Stat 51, 53, 91, 111, and one course selected from Stat 97, 105, 112	6–8

* If a student elects six semester hours of literature in any foreign language, this cannot be used to satisfy the language requirement.

† Chin 5-6 is required for East Asian Studies (China focus) majors; Japn 3-4 is required for East Asian Studies (Japan focus) majors. Greek and Latin are not acceptable for International Affairs or Public Affairs majors. Middle Eastern Studies majors may substitute other languages with the approval of the program advisor.

‡ Credit is not given for courses elected in the Department of Human Kinetics and Leisure Studies.

§ PSc 91 is not required for the Middle Eastern Studies program.

		Semester Hours
Social Science:	Econ 1–2; Hist 40 and 71–72; PSc 1 and 2	
*Elective:		
	Total	

Urban Affairs Curriculum

First two years in preparation for the Bachelor of Arts degree in the field of Urban Affairs in the School of Public and International Affairs:

English:	Engl 9 or 10, and 11 or 12	
Humanities or AmCv:	Art 31–32 or 71–72; Literature (American, Chinese, English, French, German, Greek and Latin, Italian, Slavic, or Spanish); Mus 3, 4; first- or second-group philosophy courses; Rel 21, 59–60; or AmCv 71–72	
Math/Science:	BiSc 3–4 or 11–12; Chem 3–4 or 11–12; Geol 1–2; Math 9 and 10 or 30 and 31; Phys 1 and 2 or 9–10	6–
Social Science:	Econ 1–2, Hist 71–72, and PSc 2	
	Three semester hours selected from either Hum 40 or Soc 2	
*Elective:	Students may substitute some of the required courses for the major for elective courses during the sophomore year	
	Total	

DEGREE PROGRAMS

ASSOCIATE IN ARTS DEGREE

The Associate in Arts Degree may be granted to a student who has completed 60 semester hours in arts and sciences with acceptable grades, and who has fulfilled the general requirements described on pages 71-72. In addition, the degree may be awarded to pre-public and international affairs students upon completion of the curriculum specified for the first two years of the appropriate program. The last 15 semester hours of the program of study must be completed in residence in Columbian College. A student wishing to receive this degree must file an Application for Graduation and pay the $10 graduation fee at the time of registration for the semester or summer session in which the requirements will be completed.

THE BACHELOR'S DEGREES

Columbian College offers programs leading to the degrees of Bachelor of Arts, Bachelor of Science, and Bachelor of Music.

In cooperation with the School of Medicine and Health Sciences a seven-year curriculum leading to the combined degrees of Bachelor of Arts and Doctor of Medicine is offered.

For teacher certification for Columbian College students, see page 103.

* Credit is not given for courses elected in the Department of Human Kinetics and Leisure Studies.

Requirements for the Degrees

SCHOLARSHIP

One hundred and twenty hours of course work must be passed and a quality-point index of 2.00 achieved in courses graded on a four-point scale. At least 60 hours of course work, including the general course requirements of Columbian College, must be taken outside the major-field department or major program. (This does not apply to the 129-hour Bachelor of Music curriculum.)

The index is obtained by dividing the number of quality points by the number of semester hours of courses passed with grades of *A*, *B*, *C*, or *D*. Both the number of quality points and the number of semester hours of courses are based on the student's record at this University. The index is computed as follows: *A*, four points; *B*, three points; *C*, two points; *D*, one point; for each semester hour which the student has taken. Courses marked *F*, *Z*, *W*, *I*, *IP*, *P*, or *NP* are not considered in determining the index, though courses passed with *P* count toward the 120-hour overall requirement. (When a formal grade is recorded for an Incomplete, a grade of *D* or better will be included in the computation of the index.) A grade of Incomplete which is not removed within one semester is automatically changed to an *F*. Grades earned in courses taken at another institution are not considered in computing the index. At the time of graduation, a student must be in good academic standing. See page 83 for scholarship requirements applicable specifically to departmental majors.

RESIDENCE

For the standard 120-semester-hour program—A minimum of 30 semester hours, including at least 12 hours in the major field, must be completed in residence in Columbian College. *Unless special permission is granted by the dean to pursue work elsewhere, the work of the senior year must be completed in residence.* This requirement applies to students transferring within the University as well as to students transferring from other institutions.

For the 90-semester-hour program—The last 60 semester hours, including at least 12 hours in the major field, must be completed in residence in Columbian College.

Summer work may be counted in residence toward all Columbian College degrees. For regulations governing students who are absent from the University for one semester or more, see "Leave of Absence" and "Inactive Status," pages 48-49 and 70.

CURRICULUM REQUIREMENTS

A change in degree candidacy within Columbian College (e.g., from Bachelor of Arts to Bachelor of Science) requires the permission of the dean. The degree requirements effective at the time the change is approved must be met.

First-group courses may be required as prerequisites to the major, but because of their introductory character they cannot be counted as part of such programs. (See "Explanation of Course Numbers," pages 198-99.)

PASS/NO PASS OPTION

A junior or senior student in Columbian College who is in good standing

may, with the approval of the advisor and the dean, take one course a s mester and receive a grade of *P*, Pass, or *NP*, No Pass. No student wi be allowed to take more than four pass/no pass courses under thi regulation. The student may, however, also receive grades of *P/N* in the proseminar for field-of-study majors and in other courses normall using such grades. A student must sign up for the pass/no pass optio at registration. Under no circumstances may a student change fro pass/no pass status to graded status, or vice versa, after the end o registration. Courses required in the student's major field (courses re quired in the major department or those required outside the major de partment) may not be taken on the pass/no pass basis. A transfer stu dent may not choose this option until the second semester of enrollment i this University.

TUTORIAL STUDY

A junior or senior of demonstrated capacity, with a special interest in th subject matter of a regularly listed course, may be permitted to take tu torial study in residence under the personal direction of the instructor, in accordance with the rules of the appropriate department and with the approval of the dean. Credit under this plan is limited to the specific semester hours of credit designated for each course in the list of courses of instruction. It assumes frequent and regular conferences between the student and instructor.

THE STANDARD 120-SEMESTER-HOUR PROGRAM

One hundred and twenty semester hours of course work are required for graduation. At least 60 hours of course work must be taken outside the major department or program. The student should consult the advisor at each registration about choice of courses.

Each student should declare a major as soon as possible, preferably upon completion of 30 semester hours. A student may change the major with the consent of the dean and of the department or committee concerned; the student must meet the requirements for the new major in effect at the time the change is approved.

Students transferring from other institutions or from other schools, colleges, or divisions in this University, with major requirements wholly or substantially met, must satisfy the residence requirement of Columbian College (see page 79).

THE 90-SEMESTER-HOUR PROGRAM

The 90-semester-hour degree program is designed for the exceptionally able student. This program, which leads to the regular Columbian College degrees, makes it possible to graduate in three normal academic years with a total of 90 semester hours of credit instead of the standard 120. Students in this program must complete all of the requirements for the three-year degree in the semester in which the 90th semester hour is achieved.

The requirements for this program are (1) 90 semester hours of credit earned in college courses (that is, the 90-hour requirement may not be reduced by credit earned through examinations); (2) completion of the chosen major-field program and general curricular requirements; (3) grades of *A* in at least 45 semester hours of course work and no grades below *C*; (4) at

least 60 semester hours of credit earned in 100-level courses; and (5) recommendation of the major department or program.

To be eligible for this program, the student must show evidence of exceptional academic ability by college record, performance in college courses, and other appropriate information.

An interested student should make application directly to the major-field departmental chairman or program director as soon as possible, preferably by the end of the first year of study. The student's academic record to that point will, of course, provide a useful criterion of eligibility.

A transfer student may qualify for graduation under the 90-hour program provided the student completes at least 60 semester hours of the approved 90-hour program in Columbian College, earns grades of *A* in no less than 45 semester hours of such course work at this University, and has no grades below *C*.

A student who fails to maintain the required academic performance while studying toward the 90-hour degree program simply continues for the standard 120-hour degree.

Bachelor of Arts

The Bachelor of Arts degree is offered in the following fields:

American Civilization
American Literature
Anthropology
Applied Mathematics
Applied Statistics
Art History
Biology
Botany
Chemistry
Chinese Language and Literature
Classical Archeology and Anthropology
Classical Archeology and Classics
Classical Humanities
Dramatic Art
Early Modern European Studies
Economics
English Literature
Environmental Studies
Fine Arts
French Language and Literature
General Curriculum in the Liberal Arts
Geography
Geology
Germanic Languages and Literatures
History
Journalism
Judaic Studies
Latin American Studies
Mathematical Statistics
Mathematics
Music
Philosophy
Physics
Political Science
Psychology
Radio-Television
Religion
Russian Language and Literature
Russian Literature and Culture—in Translation
Sociology
Spanish-American Literature
Spanish Language and Literature
Speech Communication
Speech Pathology and Audiology
Statistics (Computer Science option)
Zoology

Combined Degrees of Bachelor of Arts and Doctor of Medicine

A candidate for the combined degrees of Bachelor of Arts and Doctor of Medicine must (1) complete the entrance requirements for the Doctor of Medicine degree in the School of Medicine and Health Sciences; (2) complete the general requirements stated on pages 71-72 and 80; (3) accumulate 90 semester hours in the liberal arts, including a minimum of 30 in

second-group courses in Columbian College; (4) obtain the approval the Dean of Columbian College at the time of entering the School Medicine and Health Sciences; (5) obtain the recommendation of the De for Academic Affairs of the Medical Center at the completion of all p scribed courses in the first year of the School of Medicine and Heal Sciences, at which time the degree of Bachelor of Arts will be confer (professional work taken at another institution will not satisfy the maj requirement of the combined degrees); (6) maintain throughout the enti course the scholarship level required for graduation.

Bachelor of Science

The Bachelor of Science degree is offered in the following fields:

Applied Mathematics
Applied Statistics
Biology
Botany
Chemistry
Environmental Studies
Geology
Geology (Engineering option)
Mathematical Statistics
Mathematics
Physics
Statistics (Computer Science option)
Zoology

The Undergraduate Major

There are two types of undergraduate majors: the Field-of-Study majo and the Departmental major. Five majors—Classical Archeology and An thropology, Classical Archeology and Classics, Environmental Studies Judaic Studies, and Latin American Studies—although interdepartmental in nature, are governed by the regulations of the Departmental major.

FIELD-OF-STUDY MAJOR

Each Field-of-Study major covers a carefully worked out field of coordi nated study and is under the supervision of the appropriate departmen and the Columbian College Committee on Curriculum.

The Field-of-Study major requires no specific program of courses, al though the student is required to meet the over-all general requirements for the degree. Ability to pass the Major Examination is assumed to be a convincing demonstration that the student possesses the breadth, depth and quality of knowledge of the major usually defined in terms of semester hours, courses, and grades. Information on each field is obtainable from the department. Immediately upon declaring a major, students should con sult the appropriate department so that they may be assigned an advisor.

The Field-of-Study major places special emphasis on the intellectual development of the individual student. Programs in the same major may vary, depending upon the individual student's background, previous study, and aptitudes. The student is expected to consult the advisor frequently, and the special proseminars offered in some fields give the student further opportunity for individual advice and direction in pursuing a program especially adapted to individual needs and abilities. A close student-advisor relationship is essential for the student's success under the Field-of-Study major plan.

The following Field-of-Study majors are offered: American Civilization, American Literature, Chinese Language and Literature, English Literature,

French Language and Literature, History, Russian Language and Literature, Russian Literature and Culture—in Translation, Spanish-American Literature, Spanish Language and Literature.

Proseminar in the Major—A proseminar is offered in most fields to help the student acquire a coordinated knowledge of the chosen field through reading, study, and laboratory exercises. It is a presentation of the content and methods of the major field as a whole through the organization and coordination of the knowledge obtained in the various formal courses in the major subject and of material not usually included in such courses. This course is not required, but, if it is elected, strict attendance is essential. Six semester hours, but no qualitative grade, may be assigned. When registered in this course, the student has the privilege of visiting, subject to the approval of the instructor, any other appropriate course offered in the College. (Regular attendance in a course, either for credit or as an auditor, requires registration and payment of tuition.) Proseminars are open only to the student who has been accepted as a candidate under that specific major.

The Major Examination—The Major Examination will normally be taken at the close of the senior year; a student on a limited schedule may take it no earlier than one calendar year before graduation. A student who fails to pass a Major Examination may, at the discretion of the Committee on Curriculum, be re-examined at a later regular major-examination period. The Committee on Curriculum has general supervision of the preparation, reading, and grading of Major Examinations. Major Examinations are held each semester on dates fixed by the department or departments concerned, but in no case later than December 1 for the fall semester, April 13 for the spring semester, and August 26 for the summer sessions.

DEPARTMENTAL MAJORS

Departmental majors, unlike Field-of-Study majors, are defined in terms of credit hours, required courses, and the attainment of grades no lower than C in the minimum required second-group courses taken in the major field. A *D* in a required course will satisfy a curricular requirement in the major, but it will not count toward the minimum number of hours required in the major. (A department may require a degree candidate to repeat a required course in which a *D* was received. See page 45.) The minimum specific requirements for Departmental majors are listed below the staff of instruction of the department concerned. The chairman of the department, or designated departmental advisor, should be consulted at registration concerning the student's program of courses; and the entire program, including electives, must be approved by the department. The student is also expected to consult the chairman or advisor in all matters affecting the program of studies, such as changes, substitutions, or withdrawals, and especially concerning the student's progress in a course. A close student-advisor relationship is desirable.

Departmental majors are offered in the following: American Literature, Anthropology, Applied Mathematics, Applied Statistics, Art History, Biology, Botany, Chemistry, Classical Archeology and Anthropology (interdepartmental), Classical Archeology and Classics (interdepartmental), Classical Humanities, Dramatic Art, Economics, English Literature, Environmental Studies (interdepartmental), Fine Arts, General Curriculum in

the Liberal Arts, Geography, Geology, Geology (engineering option), G
manic Languages and Literatures, History, Journalism, Judaic Studies
terdepartmental), Latin American Studies (interdepartmental), Mat
matical Statistics, Mathematics, Music, Philosophy, Physics, Politi
Science, Psychology, Radio-Television, Religion, Russian Language
Literature, Sociology, Speech Communication, Speech Pathology and
diology, Statistics (computer science option), Zoology.

MINORS

Students who wish to familiarize themselves with a field outside th
major may graduate with a minor in addition to the major. Not all Colu
bian College departments offer undergraduate minors; the requiremen
prescribed by those that do are listed under the department involve
A student interested in a minor should consult faculty advisors in t
department concerned and declare both major and minor programs on t
appropriate form available in the dean's office.

At least one half of the course work required for a minor must
done in residence. Grades of C or better must be earned in second-gro
courses, including such courses transferred as advanced standing fr
another institution. Courses passed with a *D* may be used to fulfill
minor field curricular requirement, but may not be counted toward t
total number of credit hours required for the minor.

DOUBLE MAJORS

With the prior approval of the departments concerned, a student wh
completes the requirements of two major fields in Columbian College (fo
example, mathematics and physics, or English and French, or history an
economics) may graduate with a double major. Such a student shou
consult with advisors in the two departments concerned and officiall
declare both majors on the appropriate forms available in the dean
office. A double major must be taken in departments offering the sam
degree (either the B.A. or the B.S.); a major field in Columbian Colleg
cannot be combined with a major field offered by another degree-grantin
unit of the University.

INTERDISCIPLINARY PROGRAMS

Regular Interdisciplinary Programs—Several programs presently exis
including American Civilization; Classical Archeology and Anthropology
Classical Archeology and Classics, Early Modern European Studies, Env
ronmental Studies, Judaic Studies, and Latin American Studies.

Special Interdisciplinary Programs—A student who finds no existing
major or program suited to individual educational goals may develop a
special major program, in consultation with appropriate departmental ad
visors. Final approval of such a program rests with the Committee on Cur
riculum. Only programs with valid and clearly defined academic goals will
be approved, and each shall be designated by a title suggested by the
student to the Committee on Curriculum for approval. At least 45 semester
hours of credit of the approved program must be completed in Columbian
College. Because of their broad scope, such interdisciplinary majors may
not be combined with a double major.

A student in an interdisciplinary program will be expected, during the second semester of the senior year, to take a comprehensive examination (either oral or written) in the interdisciplinary field, or to undertake a senior comprehensive thesis, at the discretion of the student's interdepartmental committee.

Special Interdisciplinary Courses—Under the supervision of the Committee on Curriculum, new courses will be offered each semester combining the methods and insights of several disciplines. Interested students should consult the current *Schedule of Classes*, where they will find such courses numbered in the 700s. A student wishing to use any of these courses to satisfy the requirement of meaningful initiation into the three divisions of knowledge (see Columbian College General Course Requirements) should consult the sponsoring department.

General Curriculum in the Liberal Arts—Directed by the Curriculum Committee of Columbian College of Arts and Sciences, this program is designed to provide a general education in the liberal arts, with or without a major, as the student chooses. It offers opportunity for achieving a substantial acquaintance with each of the three divisions of knowledge through a selection of courses that cultivate a broad perspective in time and in national and/or cultural traditions. The committee appointed to advise students in the program consists of one representative each from the humanities, the social sciences, and the natural and mathematical sciences. For curriculum requirements, see pages 312-13.

GRADUATE SCHOOL OF ARTS AND SCIENCES

Dean H. Solomon
Assistant Deans A.D. Andrews, E.A. Caress, D.A. Rowley, C.E. Rice

FACULTY AND CONSULTANTS 1981-82

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* The President of the University, the Vice President for Academic Affairs, the Registrar of the University, the Director of Admissions of the University, and the University Librarian are ex officio members of the Faculty of the Graduate School of Arts and Sciences.

M.A. Holman, C. Hsieh, K. Huang, R. Hugh, R.L. Humphrey, Jr., M.J. Jac
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R.K. Lewis, H.W. Lilliefors, R.C. Lindholm, C.D. Linton, T.P.G. Liverm
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Field of Studies Consultants

R.V. Allen, D. Ari, T. Bower, I. Breger, J. Carr, G. Evans, J. Federico, A. Fern, J. Flint, J. Fulton, R.P. Hallion, S. Hobbs, H.J. Hogan, A. Jabbour, J.B. Kuiper, A. MacTavish, V. McKay, E. Myette, J.N. Norris IV, J.C. Osborne, Jr., H.Z. Rand, N.L. Sass, S.I. Shibko, P.C. Spehr, J.W. Witherell

HISTORY AND ORGANIZATION

The Graduate School of Arts and Sciences is responsible for advanced study and research leading to Master's degrees in the arts and sciences and the degree of Doctor of Philosophy. Graduate programs at George Washington University were first formally organized under the Graduate School in 1905, following several decades of gradual growth in a number of departments. In 1930 the Graduate School was discontinued. Columbian College, the University's liberal arts college, then assumed responsibility for the Master of Arts and Master of Science degrees, and a newly created Graduate Council administered all Doctor of Philosophy programs. Professional schools took responsibility for advanced degrees in the professional fields.

In 1967 the Graduate Council and the Graduate Division of Columbian College were consolidated into a new Graduate School of Arts and Sciences. All graduate programs in the arts and sciences leading to the degrees of Master of Arts, Master of Arts in Special Studies, Master of Fine Arts, Master of Forensic Sciences, Master of Music, Master of Science, Master of Science for Teachers, Master of Science in Forensic

Science, Master of Science in Special Studies, and Doctor of Philoso
are under the Graduate School.

In addition, a Master of Philosophy degree is awarded by the Sch
upon recommendation of the appropriate department, to students
have successfully completed the General Examination for the Docto
Philosophy degree.

The School is under the direction of the Graduate Faculty of Arts
Sciences. It is the responsibility of the Faculty to set the requirements
admission to the School, to provide courses and programs of study
research for its students, to establish academic standards for its degr
to recommend to the Board of Trustees the awarding of degrees, to
down regulations as needed for the operation of the School, and genera
to supervise its activities.

The administration of the School is vested in the dean, who is chairm
of the Dean's Council, which is responsible to the Faculty of the Sch
for all policy matters.

ADMISSION REQUIREMENTS

Application forms for admission to graduate study are obtained from
Office of the Dean of the Graduate School of Arts and Sciences. Wh
completed, these application forms must be submitted to this office,
gether with college transcripts and letters of reference, and other inform
tion as required by the department or program. Admission is dependent
departmental recommendation and approval by the dean.

Applicants must have academic backgrounds of excellence, usually wi
majors, or equivalent, in the fields in which they intend to study for a
vanced degrees. Normally, a *B* average (or equivalent) from an accredite
college is required. With evidence of special promise, such as high Grad
ate Record Examination scores, an applicant may be accepted who
academic record falls short of *B*. The minimum does not assure automat
acceptance. The departments may, and often do, set higher admissi
standards. Moreover, the number of spaces available for new gradua
students limits the number that can be accepted. Students who apply
their senior year must have completed their baccalaureate work befo
registration in the Graduate School and must present evidence of su
completion. The Graduate School requires the Graduate Record Examin
tion (aptitude test only) for all Ph.D. applicants except foreign nationa
Some departments require the aptitude test for applicants for the master
degree, and some require a Graduate Record Examination advanced te
for all applicants. Students whose native language is not English are r
quired to take the *Test of English as a Foreign Language* (TOEFL), a
ministered by the Educational Testing Service, Princeton, N.J. (see pag
26). International applicants already in Washington may take the Un
versity's English Placement Test in lieu of the TOEFL.

Application for Admission—Applicants who are requesting fellowshi
support must submit completed applications by February 15 (February
for students in clinical psychology and art therapy) for admission in th
fall semester and by November 1 for admission in the spring semester
Completed applications for graduate study without fellowship support mus
be received by July 1 for the fall semester, by December 1 for the spring

emester, and by April 15 for the summer sessions, unless otherwise noted.

Readmission—A student who wishes to resume a graduate program which had been interrupted, must file an application form to be considered for readmission. Readmission is not guaranteed, and the application is subject to review by the department concerned and the dean. The student may be required to take qualifying examinations on the course work completed. Application forms are available in the Graduate School Office.

REGULATIONS

Regulations regarding admission, registration, fees, and finances are stated on pages 19-32; other University regulations, on pages 44-52.

In addition, the Graduate School publishes a Student Handbook each academic year which contains updated information on the School's policies, regulations, and other matters of concern to enrolled or admitted students. It is the responsibility of the student to be aware of the information contained in this *Bulletin* and the Handbook.

Grades

Grades for graduate work are *A*, Excellent; *B*, Good; *C*, Minimum Pass; *F*, Fail; *I*, Incomplete; *IP*, Progress; *W*, Authorized Withdrawal; *Z*, Failure, Unauthorized Withdrawal; *CR*, Credit.

The symbol *I* (Incomplete) indicates that a satisfactory explanation has been given to the instructor for the student's failure to complete the required work for a course. The "Incomplete" must be made up before the lapse of one calendar year. An "Incomplete" for regular course work which is not removed within one calendar year remains permanently as a grade of *I* on the student's record. The grade of *I* cannot be removed by reregistering for the course here, or by taking its equivalent elsewhere.

The grade of *I* is also given for all thesis and dissertation research courses until the thesis or dissertation is completed. Upon the satisfactory completion of the thesis or dissertation the grade *I* is changed to *CR* automatically. The grade of *CR* is given for an *Advanced Reading and Research* (usually numbered 398) course.

Scholarship Requirements

Graduate students are required to maintain a minimum accumulative grade average of *B* (3.00) in all course work taken following admission to the Graduate School. Individual departments may require a higher average. The fields of art history and English require a 3.25 average. If the required grade average is at any time not maintained, the student's degree candidacy is subject to termination.

In the case of a student who receives a grade of *F* for a course in the program of studies, the Graduate School will require a written statement from the department justifying the student's continuance in the Graduate School and outlining the program to be followed. Continuation is contingent upon the dean's approval. When a grade of *F* is received for a course in the program of studies, the grade is included in the student's grade point average whether or not the course is repeated.

A student may repeat for credit a course in which a grade of *C* or above was received only when permitted to do so by the department concerned,

unless the course description states that the course may be repeated f credit. A written statement to this effect must be submitted for approval the dean's office by the appropriate departmental advisor. It is then fi with the Registrar. If a course is repeated for credit, the first grade ceived remains on the student's record and is included in the studen grade point average.

A graduate student may take an advanced undergraduate course (cours numbered 101-199) for graduate credit only upon the approval of the de and the department at the time of registration. Such approval is grant only with the provision that the student complete additional work in ord to receive graduate credit.

Program of Studies

The program of studies must be approved by the dean and the depar mental advisor and filed in the Graduate School Office no later tha November 1 for graduate students entering in the fall semester, or Marc 15 for graduate students entering in the spring semester. A program o studies may be revised, when necessary, by obtaining the approval of th departmental advisor and the dean. The revision must be filed in th Graduate School Office. A completed course cannot be dropped fro the program of studies unless it is due to an error in advising or a administrative error. Such a change in the program requires the approval o the dean.

Probationary Students—It is especially important for those admitte as probationary students to consult with their departmental advisor a early as possible regarding completion of special requirements, whic are specified in the letter of admission. The exact conditions for admissio of probationary students must be satisfied.

Continuous Enrollment

All students must be continuously enrolled while working toward degree, except during the summer sessions. If continuous enrollment i not maintained, the student is dropped from the degree program unles a leave of absence is granted by the Graduate School.

Master's candidates should meet the calendar deadline for completin the degree as specified in the program of studies. If the deadline is no met, assuming academic approval for an extension which may be grante in exceptional circumstances, the student must register and pay for six credit hours of "Reading and Research" each semester.

Doctoral students in the first unit of their programs shall meet the calendar deadline for completing this unit as specified in the program of studies. Completion of the first unit includes satisfactory completion of course work, tool requirements, and the General Examination. If the deadline is not met, assuming academic approval for an extension which may be granted in exceptional circumstances, the student must register and pay for six semester hours of "Reading and Research" each semester. These hours will not be credited toward completion of the degree. Doctoral students in the second unit of their programs, i.e., dissertation research, should complete this unit as specified in the program of studies. If the deadline is not met, assuming academic approval for an

xtension which may be granted in exceptional circumstances, the student nust register and pay for six semester hours of "Reading and Research" ach semester.

eave of Absence

A student who is temporarily unable to continue the program of studies nay request leave of absence for a specific period of time, not to exceed ne calendar year during the total period of degree candidacy. When he period of leave has expired, it is the student's responsibility to otify the Graduate School at least two months in advance of a given egistration period of intention to reregister. If a student fails to re-register, he candidacy is terminated.

Withdrawal

Graduate students who intend to withdraw from the Graduate School hould inform the School in writing. The last day for *complete* withdrawal without academic penalty is at the end of the eighth week of classes.

Graduation Requirements

All students must file an Application for Graduation and pay the required graduation fee at the time of registration for the last semester or summer session of the final year in which they intend to graduate. Students must be registered in the Graduate School during the semester they plan to graduate. Master's and doctoral candidates may graduate in May, February, or September. Students who have completed the requirements for a degree but have not yet been awarded the degree will be issued a letter to this effect upon request.

DEGREES

Listed below are the degree programs of the Graduate School of Arts and Sciences and the specific degrees offered, by field. The programs are directed by the departments concerned. Degree programs which bridge two or more departments are directed by committees composed of members of the departments concerned. For further information write to the dean or the chairman of the appropriate department.

The degrees of Master of Arts in Special Studies and Master of Science in Special Studies are designed for students who do not wish to concentrate in a specific discipline. The Graduate School of Arts and Sciences offers programs on campus leading to the degree of Master of Arts in Special Studies with concentration in Crime in Commerce, Criminal Justice, Environmental Policy, Gerontology, Women's Studies, and Philosophy and Social Policy.

Students with special academic goals may pursue individualized programs of study toward the M.A. or M.S. in Special Studies subject to approval by the Committee on Individual Programs and the dean. Courses must be drawn from a minimum of three fields, with a maximum of 18 hours from any one field. A majority of courses must be taken within the Graduate School of Arts and Sciences. Also required is a one-semester

colloquium on interdisciplinary methods. The nature of the comprehensive examination is a final essay in which the integration of the program of study is demonstrated. The School also offers Master of Arts in Special Studies and Master of Science in Special Studies degrees in specific academic areas at off-campus locations (see page 100).

Graduate Fields

The graduate course work offered in support of the degree programs in the following list is shown by department in this *Bulletin*.

	Degrees Offered	
I. Humanities		
American Civilization	M.A.	Ph.D
American Literature	M.A.	Ph.D
Art:	M.F.A.	
Ceramics		
Design		
Graphics		
Painting		
Photography		
Sculpture		
Visual Communication		
Art History	M.A.	Ph.D
Dramatic Art	M.F.A.	
English Literature	M.A.	Ph.D
*French Literature	M.A.	Ph.D
History of Religions—Hinduism	M.A.	
Museum Studies	M.A.	
Music:	Mus.M.	
Applied Music		
Composition		
Conducting		
Music Theory		
Musicology	M.A.	
Religion	M.A.	
Religion and Medical Care	M.A.	
Religious Education	M.A.	
Russian Language and Literature	M.A.	
*Spanish-American Literature	M.A.	Ph.D
*Spanish Literature	M.A.	Ph.D
II. Social Sciences		
Administrative Science	M.A.	
Anthropology	M.A.	Ph.D
Economics	M.A.	Ph.D
Education Policy		
Geography	M.A.	Ph.D
History	M.A.	Ph.D
Political Science	M.A.	Ph.D
Public Policy		
Sociology	M.A.	Ph.D

* Any approved combination of French, Spanish, or Spanish-American Literature is available as a Doctor of Philosophy field.

III. Physical and Mathematical Sciences

Applied Mathematics	M.A., M.S.	
Applied Statistics	M.S.	
Chemical Toxicology	M.S.	
Chemistry	M.S.	Ph.D.
Engineering Geology	M.S.	
Forensic Sciences	M.F.S., M.S.F.S.	
Geobiology	M.S.	Ph.D.
Geochemistry	M.S.	Ph.D.
Geology	M.S.	Ph.D.
Mathematical Statistics	M.A.	Ph.D.
Mathematics	M.S. for Teachers, M.A.	Ph.D.
Physics	M.A.	Ph.D.

IV. Biomedical and Related Sciences

Anatomy		Ph.D.
Art Therapy	M.A.	
Biochemistry	M.S.	Ph.D.
*Biological Sciences	M.S.	Ph.D.
Genetics	M.S.	Ph.D.
Microbiology	M.S.	Ph.D.
Pathology		Ph.D.
Pharmacology	M.S.	Ph.D.
Physiology	M.S.	Ph.D.
Psychology	M.A.	Ph.D.
Radiological Sciences		Ph.D.
Speech-Language Pathology and Audiology	M.A.	

Combined Master of Science and Doctor of Medicine Degrees

Students interested in the combined degrees of Master of Science and Doctor of Medicine must meet the requirements for admission to the Graduate School of Arts and Sciences and to the Doctor of Medicine degree program of the School of Medicine and Health Sciences.

The Master of Science program consists of a minimum of 30 semester hours of credit and the fulfilling of the tool requirement (see page 95). A maximum of 12 semester hours of credit for graduate-level courses completed as a part of the Doctor of Medicine degree curriculum (and not already applied toward the bachelor's degree) will be allowed in fulfillment of the requirements of the Master of Science degree. The remaining 18 semester hours of work, which in most programs incudes a thesis, must be work in the basic medical sciences normally required for a Master of Science degree in the Graduate School of Arts and Sciences.

Joint Master's–Juris Doctor Program

Students interested in working concurrently toward the Juris Doctor degree in the National Law Center and a master's degree in the Graduate School of Arts and Sciences must meet the requirements for admission to both schools and all requirements in each degree program. It is possible for a student to complete work for both degree programs within four years.

* Biology, botany, and zoology.

Dual Program for Doctor of Medicine and Doctor of Philosophy Degrees

A dual program is available to qualified students who seek both the Doct of Medicine and Doctor of Philosophy degrees. The requirements whi must be fulfilled for both degrees are identical to those currently a separately established in the School of Medicine and Health Sciences a the Graduate School of Arts and Sciences.

A student working toward these degrees may apply a maximum of semester hours of approved course work in the School of Medicine a Health Sciences toward the minimum of 48 hours of course work requir to qualify for the General or Cumulative Examination for doctoral cand dacy. This course work is normally taken during the semesters that alte nate with the medical program and in the years following the award the M.D. degree. The student's research for the dissertation may beg concurrently with the final 24 semester hours of graduate course wor leading to the General or Cumulative Examination. The estimated tim for the completion of this dual program is six years.

In order to enter the dual degree program, a prospective student firs must apply for and gain admission to both the Graduate School of Arts an Sciences and the School of Medicine and Health Sciences separate through established procedures. Upon admission to both schools, th student may then apply for affiliation with the dual degree program. Wor toward the Doctor of Philosophy degree is performed under the jurisdic tion of a departmental doctoral committee.

REQUIREMENTS FOR THE DEGREES

The Master's Programs

Unless otherwise specified, the requirements listed below are applicabl to candidates for the degrees of Master of Arts, Master of Arts in Specia Studies, Master of Fine Arts, Master of Forensic Sciences, Master Music, Master of Science, Master of Science for Teachers, Master Science in Forensic Science, and Master of Science in Special Studies.

1. *General Requirements*—For a master's degree program *including* thesis, the satisfactory completion of a minimum of 30 semester hours approved graduate work, including six semester hours of thesis research is required. For a master's degree program which does *not* include thesis, the number of semester hours of approved graduate course work determined by the department, and normally consists of from 30 to 3 semester hours. The program without the thesis is not an individual stu dent option and is not available in every department. Departments ca and often do set requirements above the minimum required by the Gradu ate School. The program of study leading to the degree of Master of Art in Special Studies or Master of Science in Special Studies consists of 3 semester hours of approved graduate course work and does not require thesis.

Work taken to make up deficiencies is never counted as part of the requirements leading to a master's degree. Upon approval, up to one-hal of the required graduate work may be taken in courses offered by the other affiliated institutions of the Consortium of Universities of the Wash ington Metropolitan Area, Inc., or by another degree-granting division of

this University. If credit is transferred from another institution (see "Transfer of Credit," below), the number of semester hours which may be taken at an affiliated Consortium institution is reduced by the number of hours accepted as transfer credit.

All master's degree candidates must complete degree requirements within four years. Extensions beyond this time period require approval of a written request based on specific and temporary interfering circumstances.

2. *Academic Work Load*—Full-time students register for nine to 12 semester hours each semester; part-time students must register for six semester hours each semester. These requirements do not apply to students who have fewer than nine semester hours (full-time) or six semester hours (part-time) remaining to complete their programs. No more than 15 semester hours may be taken during any one semester.

3. *Transfer of Credit*—A maximum of one-quarter of the semester hours of graduate course work required for a degree may be approved for transfer to the Graduate School from the Division of University Students, another degree-granting division of this University, or another accredited college or university. For a transfer of credit to be approved *all* of the following conditions must be met: the course work must have been taken prior to admission to the Graduate School, it must be approved as part of the student's program of studies, it must not have been applied to the completion of requirements for another degree, it must be post-baccalaureate graduate-level course work, it must have been taken within the past two years, and the student must have received a grade of *B* or better in each course for which a transfer of credit is requested. This action must be made in writing and approved by the departmental advisor and the dean. A transcript of the course work must be on file before the request can be considered.

4. *Tool Requirement*—Candidates for the degrees of Master of Arts in the fields of administrative science, art therapy, and speech pathology and audiology (nonthesis option), Master of Arts in Special Studies, Master of Forensic Sciences, Master of Music, Master of Science in the field of chemical toxicology, and Master of Science in Special Studies; candidates for master's degrees in the Department of Mathematics; and candidates for the degree of Master of Fine Arts in the field of dramatic art need not fulfill a tool requirement. Master's candidates normally must successfully complete a tool requirement in a foreign language, mathematics, statistics, or computer programming, or by graduate course work outside the major department (see option [c] below). In place of a tool requirement, candidates for the degree of Master of Fine Arts in the fields of ceramics, design, graphics, painting, photography, or sculpture will complete a methods course selected by the Department of Art.

The tool requirement examination should be passed prior to the beginning of the third semester of graduate work; students who have not fulfilled this requirement must register for the appropriate course at the beginning of the third semester. Students who elect graduate course work outside the major department in order to fulfill the tool requirement must complete this course work before taking the comprehensive examination or undertaking thesis work. Courses taken to satisfy the tool requirement usually cannot be counted in the semester-hour requirement for the

master's degree. No master's candidate may attempt a tool examinati more than three times. A tool requirement fulfilled at another univers cannot be used to fulfill the requirement at this University.

With the approval of the department directing the student's progra of study, the tool requirement may be selected from the following option

(a) Passing a foreign language reading examination (a student ma register for the appropriate reading course for nonmajors or make arrang ments with the appropriate department to take the examination on th scheduled dates). A student majoring in a foreign language may not sele that language to satisfy this requirement. English may not be elected as tool requirement.

(b) Completing a course in mathematics, statistics, or computer progra ming which is approved by the appropriate department and by the Grad ate School; or passing a special examination covering the approved cours material, administered by the appropriate department, at the level of th final examination.

(c) Completing with a grade of *B* or better a minimum of six semest hours of graduate course work in a department other than the student's major department. Three semester hours of this course work will not b counted toward the minimum semester-hour requirement of the student's degree program.

5. *The Thesis*—The main purpose of a master's thesis is to demonstrat the student's ability to make independent use of information and train ing, and to furnish objective evidence of constructive powers in a chose field. The student registers for six semester hours of thesis research an must complete the thesis no later than four calendar years after the initial registration. Registration for thesis research entitles the studen to the advice and direction of the member of the faculty under whom the thesis is to be written. The thesis subject must be approved by the faculty member who will be directing the thesis. The thesis, in its fina form with one copy and a certificate of approval signed by the thesis di rector and by at least one departmental reader, must be presented to the dean no later than the date announced in the University Calendar. All theses must meet the form, style, and other requirements set forth in a pamphlet, *Information Concerning Theses and Dissertations*, available in the Office of the Dean.

6. *Master's Comprehensive Examination*—Most master's degree candi dates must pass a Master's Comprehensive Examination in the major sub ject. Examinations are held on dates fixed by the departments, so that results can be filed in the Graduate School Office no later than the day before the faculty meets to approve the list of graduates. The nature and form of the examination is the responsibility of the department or program

A student who fails to pass the Master's Comprehensive Examination may, in exceptional circumstances, and with the approval of the depart ment and the dean, repeat the examination at the next scheduled examina tion date. If the student fails a second time, no further opportunity to take the examination is permitted.

The Doctor of Philosophy Program

The minimum requirements for the doctoral program are as follows:

1. *General Requirements*—The program leading to the degree of Doctor of Philosophy requires the satisfactory completion of a minimum of 72 semester hours of approved graduate work for entering students whose highest earned degree is a baccalaureate. A minimum of 48 of these hours must be taken in preparation for the General Examination. Entering students whose highest earned degree is a master's degree are required to register for a minimum of 48 semester hours of approved graduate work, no fewer than 24 of which must be taken in preparation for the General Examination. While completing the dissertation portion of the program, the student must register for 12 to 24 semester hours of dissertation research, depending on the number of hours completed prior to the General Examination. The exact number of semester hours required for any part of the total program is assigned by each department and may exceed the minimum required by the Graduate School.

2. *Academic Work Load*—Full-time students register for nine to 12 semester hours each semester; part-time students must register for six semester hours each semester. These requirements do not apply to students who have fewer than nine semester hours (full-time) or six semester hours (part-time) remaining to complete their programs.

3. *Transfer of Credit*—Entering students who do not hold a master's degree may request transfer of up to 24 semester hours of credit toward a doctoral degree for acceptable post-baccalaureate graduate work taken at the master's degree level at George Washington University or another accredited college or university.

4. *Tool Requirements*—As early as possible, and *before* completion of the General Examination, the tool requirements specified in the program of study must be completed. Various options are available for fulfilling the tool requirements: each department may permit certain options and not others, and all individual choices of tool options must have the approval of the student's department and of the Graduate School. Options for fulfilling tool requirements are as follows:

(a) Two foreign language reading examinations. English may not be elected as a tool requirement.

(b) High-level proficiency in one foreign language. (See the Graduate School of Arts and Sciences *Student Handbook* for further information.)

(c) Substitution for one foreign language reading examination of an examination, conducted by the appropriate department, in mathematics, statistics, or computer science. An examination in a graduate course at this University may satisfy this requirement.

(d) Substitution of certain graduate course work as follows: a minimum of six semester hours, completed with grades of *B* or better, in a department other than the student's major department, in place of one foreign language reading examination. Certain departments may permit options (c) and (d) in place of both foreign language reading examinations; certain departments, as well, may permit 12 hours of graduate course work in another department to satisfy the tool requirement.

Students permitted to elect options (a) or (c) above who enter the Graduate School with a bachelor's degree must satisfy the first tool requirement before completion of 15 semester hours of course work; students entering with a master's degree must satisfy the first tool requirement no later than the second semester of registration as a candidate for the Doctor

of Philosophy degree. Courses taken to fulfill the tool requirement und options (a), (b), and (c), and three of the semester hours' credit earn under option (d) (six if option [d] is permitted in place of both forei language reading examinations) will not be counted toward the minimu semester hour requirement for the degree.

Further information regarding the various tool requirements is stat in the Graduate School's *Student Handbook*.

5. *The General Examination*—Each student is required to complete th General Examination no later than the semester following the completio of course requirements. The General Examination is composed of written examination five to six hours in length in each of the areas of stud comprising the student's total program; the time permitted between eac examination is determined by the administering department. Some de partments permit one or two areas of study to be "written off"; that is, special, shorter examination is given after a year of course work in th area. A cumulative examination system is in effect in the fields of chem istry and physiology, and in the field of psychology a system of two com prehensive examinations is used. Students in these fields should consu the appropriate department for information about its system.

A student who fails to pass any part of the General Examination may in exceptional circumstances, and with the approval of the departmen and the dean, repeat the examination at the next scheduled examinatio date. If the student fails a second time, no further opportunity to take th examination is permitted.

Satisfactory performance on the General Examination is required fo admission to the second stage of candidacy for the Doctor of Philosoph degree, consisting of the dissertation and final examination. Admittanc to the second stage of candidacy is permitted only if the student's Gener Examination committee finds that the student's performance on the exam nation and in course work gives a good indication of success in the secon stage. Passing of comprehensive examinations at the minimum level doe not necessarily give this indication.

6. *The Degree of Master of Philosophy*—Upon departmental recommen dation and approval of the dean, the degree of Master of Philosophy may be awarded to students who have successfully completed all requirement for the Doctor of Philosophy degree up to and including the General Exami nation. Not all departments recommend students for this degree.

7. *The Dissertation and Final Examination*—A dissertation is required of each doctoral candidate as evidence of ability to perform scholarly re search and interpret its results. The candidate normally enrolls for *Dis sertation Research* upon completion of the General Examination; however the candidate may register for up to six semester hours of *Dissertation Research* during the time the General Examination is being completed. If the dissertation is not completed within five years from the date the General Examination is completed, the student will be required to retake the General Examination.

No later than the date specified in the University Calendar, the candidate must submit to the dean the original and one copy of the dissertation and an abstract for inclusion in the Announcement of the Final Examination and for reproduction by University Microfilms, Inc.

When the dissertation has been approved by the director, two member

of the Doctoral Program Committee, and the dean, the candidate takes the Final Examination, an oral examination which is open to the public. A committee of examiners (composed of Graduate School faculty and, when appropriate, outside scholars) conducts the examination. A sufficient number of copies of the dissertation must be provided by the candidate for the members of the Examination Committee. If the candidate passes, he or she is recommended by the Graduate School for the degree of Doctor of Philosophy.

Detailed information regarding regulations for the form and reproduction of the dissertation is available in the Office of the Dean. The successful candidate for the doctorate is required, before receiving the degree, to pay a fee to cover the expense of printing the Announcement of the Final Examination, and for the basic service rendered by University Microfilms, Inc.

FELLOWSHIPS AND FINANCIAL AID

A limited number of graduate teaching assistantships and University Fellowships are available in most departments of instruction to students registered in the Graduate School of Arts and Sciences. A limited number of other kinds of sponsored and University awards are also available.

Students applying for admission who also wish to apply for a fellowship should submit the fellowship application and the application for admission by February 15; the necessary transcripts, Graduate Record Examination scores, and letters of recommendation should also be on file by this date. Students currently enrolled in the Graduate School should submit only the fellowship application and have current letters of recommendation on file by February 15.

Forms are available at the Office of the Graduate School of Arts and Sciences. Filing the fellowship application entitles the student to consideration for all awards available in the student's department.

Students who wish to apply for loans should indicate their intent to do so on the application for admission. Information concerning loans is contained in a booklet, *Student Financial Aid*, available from the University's Student Financial Aid Office.

COOPERATIVE PROGRAMS

The American Studies Program at George Washington University is affiliated with the American Studies Program of the Smithsonian Institution. This arrangement offers students in the field of American civilization an opportunity to take advantage of the Washington environment. Members of the staffs of the Smithsonian's American Studies Program, Museum of History and Technology, National Portrait Gallery, and National Collection of Fine Arts offer seminars and tutorial instruction in fields which provide students with an unusual opportunity to develop new dimensions in the discipline of American civilization. This program of study is open to students working toward the degrees of Master of Arts and Doctor of Philosophy, and is intended to prepare them for research, teaching, and museum-related careers.

The Art Department of George Washington University and the Smithsonian Institution offer a joint graduate program of study and research in museum studies leading to the degree of Master of Arts in the field of

Art History with a concentration in Museum Training. The Departme has also established a program of study in affiliation with the Corcor Gallery of Art, the Freer Gallery, the Hirshhorn Museum and Sculptu Garden, the Museum of African Art, the National Museum of Americ Art, the Phillips Collection, the Renwick Gallery, and the Textile M seum.

A program of study leading to the degree of Doctor of Philosophy American Civilization with emphasis on library research and collections offered jointly by George Washington University and the Library of Co gress. The coordinator of the Library Program and the staff offer an orie tation seminar and other courses and supervise students in reading a research and in work on such library problems as indexing, cataloguin and bibliography.

For further information concerning these programs contact one of th following offices at George Washington University: the Graduate Scho of Arts and Sciences for those who are interested in any of the fields listr above, the Art Department for those interested in art museum training, th American Studies Program for those interested in the field of Americ civilization.

George Washington University, in cooperation with two other un versities and the Folger Shakespeare Library, helped establish the Folg Institute for Renaissance and 18th-century Studies as a cooperative ven ture in graduate studies in the humanities. Fifteen universities are no member institutions. Seminars (limited to 12 students each) are offer each semester under the direction of American and foreign scholars. Th Folger Library forms the core of the Institute. All participants enrolled i the seminars are granted access to the collections of rare books, man scripts, and reference materials of the Library. All registered students a eligible to apply for admission to one or more of the seminars, althou priority in enrollment will be accorded graduate students working on d sertations and postdoctoral scholars from the sponsoring institutions.

Further information, including a listing of seminar topics, is availabl in the Office of the Graduate School of Arts and Sciences or at the Folg Shakespeare Library.

The University and the National Bureau of Standards have entered int a cooperative agreement to further educational opportunity at both th University and the Bureau. This arrangement holds promise for gradua study and research, with emphasis in the physical sciences.

SPECIAL OFF-CAMPUS DEGREE PROGRAMS

The Graduate School of Arts and Sciences is currently offering the fol lowing special degree programs off campus: (1) the degree of Master o Arts in Special Studies with areas of concentration in Criminal Justice Energy Policy, Environmental and Resource Policy, Legislative Affair Social and Organizational Behavior, and Urban Learning; (2) the degre of Master of Forensic Science; and (3) the degree of Master of Science Special Studies with areas of concentration in Employment Policy, En vironmental Science, Oral Biology, Regulatory Policy, Social and Eco nomic Statistics, and Telecommunications Policy. Not all of these pro grams may be available in any given year. For details consult the Gradua School of Arts and Sciences.

SCHOOL OF EDUCATION AND HUMAN DEVELOPMENT

Dean E.W. Kelly, Jr.
Assistant Dean R.E. Baker
Executive Assistant to the Dean L.H. Kornhauser

FACULTY 1981-82*

Professors R.E. Baker, J.G. Boswell, J.L. Breen, M. Brenner, F.J. Brown, R.S. Cottrell, Jr., E.E. DuBois, L.H. Elliott, R. Ferrante, E.J. Gleazer, Jr. *(Visiting)*, D. Hawkins, G.L. Horrworth, J.D. Hunt, R.K. Ives, S. Kavruck, E.W. Kelly, Jr., E.P. Kulawiec, D. Linkowski, A. Marinaccio, M. McIntyre, D.A. Moore, L. Nadler, S.R. Paratore, D.C. Paup, M.N. Rashid, J.R. Shotel, J.E. Snodgrass, L.M. Stallings, R. Tillman, C.E. Vontress, L. Winkler

Associate Professors M. Burns, M.S. Castleberry, A.L. Dickerson *(Research)*, J.D. Fife, L.H. George, J.A. Greenberg, J.C. Heddesheimer, D.H. Holmes, N.D. Johnson, A.P. Kowalski *(Research)*, R.I. Peterson, G.W. Smith, N.J.S. Sobel, L.A. Tsantis, G.D. Wiggs, M.R. Withers, S.A. Wyman

Assistant Professors M.B. Freund, G.L. Harbin, A.E. Hunter, R.N. Ianacone, E.R. Lilly, R.A. Luke, A.J. Mazur, H. Nashman, J.R. Snider

Instructors M.T. Bailes, A.H. Farbman, P. Finnerty-Fried, J.M. Helm *(Research)*, A.H. Macomber *(Research)*, C.B. Stapp

Members of the Advanced Graduate Faculty

R.E. Baker, J.G. Boswell, J.L. Breen, M. Brenner, F.J. Brown, M. Burns, M.S. Castleberry, R.S. Cottrell, Jr., E.E. DuBois, L.H. Elliott, R. Ferrante, E.J. Gleazer, Jr., J.A. Greenberg, D. Hawkins, J.C. Heddesheimer, G. Horrworth, J.D. Hunt, R.N. Ianacone, R.K. Ives, S. Kavruck, E.W. Kelly, Jr., E.P. Kulawiec, D. Linkowski, R.A. Luke, A. Marinaccio, A.L. Mazur, D.A. Moore, L. Nadler, S.R. Paratore, D.C. Paup, R.I. Peterson, M.N. Rashid, J.R. Shotel, G.W. Smith, J.E. Snodgrass, N.J.S. Sobel, L.M. Stallings, R. Tillman, L.A. Tsantis, C.E. Vontress, G.D. Wiggs, L. Winkler

Committees†

EXECUTIVE COMMITTEE

J.L. Breen, R.S. Cottrell, R. Ferrante, D. Linkowski, R.A. Luke, L. Nadler

CURRICULUM COMMITTEE

J.G. Boswell, J.C. Heddesheimer, R.K. Ives, M.K. Rashid, L.M. Stallings, R. Tillman

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* The President of the University, the Vice President for Academic Affairs, the Registrar of the University, the Director of Admissions of the University, and the University Librarian are ex officio members of the Faculty of the School of Education and Human Development.
† The dean and the assistant dean of the School of Education and Human Development are ex officio members of all committees.

FACULTY COMMITTEE

J.A. Greenberg, E.P. Kulawiec, L. Nadler, J.R. Shotel, J.E. Snodgrass, L. Winkler

SCHOOL, COMMUNITY, AND ALUMNI AFFAIRS COMMITTEE

M.B. Freund, H. Nashman, G.D. Wiggs, M.R. Withers

STUDENT COMMITTEE

L.H. George, G.L. Horrworth, A.E. Hunter, M. McIntyre

INTRODUCTION

The University began offering professional courses for teachers in 1904-05, and in 1907 it established a Division of Education. In 1909 the Division of Education became the Teachers College which in its early years was concerned largely with teacher preparation on the undergraduate level.

In 1928 the Teachers College became the School of Education and greater provision was made for advanced study. Since that time the graduate enrollment has steadily increased, with the result that today the School has a considerably larger number of graduate than undergraduate students. To reflect the current scope of its offerings, the name of the School was changed in 1977 to the School of Education and Human Development.

The School of Education and Human Development prepares teachers, resource and support personnel, and administrators for educational service. The School also offers opportunities to experienced teachers to extend and enrich their education. The programs are designed to meet the broad needs of all persons who seek the knowledge and skills necessary to provide for effective learning and teaching. The School's programs focus on the needs of persons interested in the traditional elementary and secondary school environments, but also include the preparation of individuals for all areas of education covering the life span from pre-school through the adult years in both the public and private sectors of society. The following undergraduate programs are representative: human services, dance therapy, and dance as a performing art. The following Master's degree programs are representative: adult education, college student development, dance, early childhood education and early childhood special education, community counseling, gifted and talented, higher education, human resource development, individualized Master's, liaison special educator/parent educator, perceptual motor development, rehabilitation counseling, therapeutic recreation, tourism development and travel administration, vocational/special education.

A Bachelor of Arts in Education and Human Development is more than preparation for teaching in schools. The degree provides background and experiences for careers in a variety of public and private settings. A majority of the credit hours of required courses are in the liberal arts. In addition, the programs provide opportunities for students to develop critical thinking and reasoning, as well as leadership, organizational, and planning skills. Emphasis is placed upon developing the human relationship qualities that are essential in fields that require involvement with people in all age ranges and from all walks of life.

The School of Education and Human Development is the administrative unit for three departments: Education, Human Kinetics and Leisure Studies, and Special Education. In addition to programs of study leading to its degrees, the School offers credit and non-credit workshops designed specifically to meet the unique needs of metropolitan area school systems, and other clienteles in private industry and in government.

Special curricula are tailored on an individual basis for liberal arts graduates and graduates of other professional schools who are interested in teaching or in other human services areas. The School also offers a wide range of courses for teachers who wish to renew licenses and for provisional teachers who wish to prepare for teaching certificates.

Laboratory and clinical facilities are provided by the University Reading Center. Field experiences are provided in cooperation with public and private schools, social agencies, museums, institutions in the business community, and community and junior colleges.

The schedule of courses is arranged to meet the convenience of both full-time and part-time students.

Professional Courses for Non-Education Majors

Columbian College students in a number of major fields are permitted to use their electives to complete up to 18 credit hours of professional education courses required for teaching in middle schools and junior and senior high schools. Students may graduate with 120 semester hours or may choose to complete all courses required for teacher certification and graduate with a program in excess of 120 semester hours. Students interested in taking these courses should contact the office of the dean of the School of Education and Human Development.

Freshmen and sophomore students may take professional education courses that include field work experiences. Some of these courses make it possible for students who are undecided about their choice of a career to have an opportunity to test teaching and some of the many related helping services areas.

A number of professional education courses are open to non-education majors. It is recommended that students check with one of the three education departments for more specific information on courses that are open.

Education for Teaching

Programs of study in education for teaching are based upon the assumption that every teacher should have a broad general education, mastery of the content of instruction, and professional competencies.

The relative emphasis placed upon each of these aspects of the total education for teaching varies in accordance with the purposes of each program. For instance, since elementary school teachers teach all subjects, they require content preparation of greater breadth and less specialization than secondary school teachers.

It is the view of the School of Education and Human Development that an acceptable minimum education for teaching requires four years of full-time study or the equivalent in part-time study. For superior preparation teachers are urged to plan for five years of full-time study or the equivalent in part-time study.

The student may choose any one of the following plans to achieve superior educational preparation for teaching or for other education-related fields:

1. Upon receiving the bachelor's degree in education, he or she may take a teaching position and, after acquiring some professional experience, return to the School for graduate study leading to the master's degree. This plan enables students with bachelor's degrees to begin their teaching careers, and to use their work experience to enhance graduate study which will follow.
2. The student may choose to pursue full- or part-time graduate study leading to the master's degree immediately after receiving the bachelor's degree.
3. A student whose bachelor's degree is in one of the liberal arts disciplines may choose to complete the requirements for certification for teaching by studying in one of the teaching fields in a program custom-tailored to his or her particular needs.

REGULATIONS

University regulations concerning admission, registration, fees, and finances are stated on pages 19-32; other University regulations, on pages 44-52.

General Scholarship Requirements For Undergraduates

Regulations regarding academic standing, probation, suspension, withdrawals, classification of students, required placement examinations and waiving introductory courses by examination are the same as those for Columbian College; they appear on pages 68-69 and 73-75 of this Bulletin.

ACADEMIC WORK LOAD

Fifteen to 17 semester hours of credit constitute a normal program. A student with a quality-point index of 3.00 or higher may, with the permission of the dean, enroll for 18 or 19 hours. No student may enroll for more than 19, except by permission of the Committee on Scholarship.

The following work load regulations apply to both graduate and undergraduate students.

Students employed 15 hours or less a week may carry a normal program of college work.

Students employed from 16 to 25 hours a week may enroll for 12 or 13 hours. Those with a quality-point index of 3.00 or higher may, with special permission of the dean,* enroll for 15 or 16 hours.

Students employed from 26 to 34 hours a week may enroll for 9 or 10 hours. Those with a quality-point index of 3.00 or higher may, with special permission of the dean,* enroll for 12 or 13 hours.

Students employed 35 hours or more a week may enroll for 6 or 7 hours. Those with a quality-point index of 3.00 or higher may, with special permission of the dean,* enroll for 9 or 10 hours.

Students who increase their hours of employment after registration or at any time during a semester must report immediately to the dean so that their programs may be adjusted, if necessary.

* Request forms are available at the office of the dean. They should be filled out and returned to the office of the dean at least two weeks prior to registration.

Graduate students employed full-time may take a maximum of 6 semester hours, unless special permission to take more is granted by the dean.*

REQUIRED PLACEMENT EXAMINATIONS

English—Students whose College Board English Composition Achievement Test scores suggest that they will benefit from more intensive training in compositional skills may be assigned to English 9 or may be tested in vocabulary, spelling, grammar, standard usage, and writing skill before placement in either Engl 9 or 10.

Foreign Languages—A student who has not been granted advanced standing and who wishes to continue in college the language begun in high school must take a placement examination in one of the following: Chinese, French, German, Greek, Hebrew, Italian, Latin, Russian, or Spanish. Upon completion of the examination, assignment is made to the appropriate course.

Mathematics—New students accepted for registration in Math 30 are required, prior to registration, to take a placement examination in algebra and trigonometry; those wishing to register in Math 51 are required, prior to registration, to take a placement examination in algebra. (See specific mathematics requirements listed under elementary or secondary education majors.)

EARNING CREDIT BY EXAMINATION

Undergraduate students may earn semester-hour credits up to a maximum of 30 hours by performing satisfactorily on College-Level Examination Program (CLEP) Tests or special departmental examinations provided by the departments of Columbian College of Arts and Sciences on an individual basis. Passing a waiver examination does not entitle the student to any semester hours of credit in the School of Education and Human Development. A limited amount of credit may be assigned for selected service school instruction received since 1941.

Students interested in becoming certified to teach who have earned bachelor's or graduate degrees in fields other than education may satisfy some certification requirements by taking the CLEP Examinations or special departmental examinations. See page 22 for general information on the CLEP tests, and for information on special examinations offered by departments.

THE BACHELOR'S DEGREES

The School of Education and Human Development offers undergraduate programs leading to the degrees of Bachelor of Arts in Education and Human Development (elementary, middle school, secondary education; elementary education/early childhood education; special education: complementary teacher program; and human services) and Bachelor of Science in Human Kinetics and Leisure Studies (elementary/secondary physical education, dance education, dance therapy, and dance as a performing art).

* Request forms are available at the office of the dean. They should be filled out and returned to the office of the dean at least two weeks prior to registration.

Bachelor of Arts in Education and Human Development

The programs leading to the degree of Bachelor of Arts in Education and Human Development (elementary, middle school, and secondary education; elementary education/early childhood education, and special education: complementary teacher program) are planned to provide (1) general educational backgrounds, (2) functional command of concepts and skills in one or more teaching fields, (3) mastery of basic professional information and skills adequate for the beginning teacher, and (4) development of attitudes needed for success in teaching or in other related human services fields.

The general educational backgrounds needed by prospective teachers or by persons interested in being employed in other human services fields are obtained through college courses, work experience, leadership activities, and off-campus cultural opportunities.

As part of formal course work, and on their own initiative, students of the School of Education and Human Development are expected to take full advantage of the many opportunities in the Washington area for developing leadership skills. Advisors are available to help students plan these experiences.

Persons preparing for teaching or for work in other human services fields require a well-rounded education. Therefore, a student completing the teacher certification program will take from 72 to 96 semester hours in the liberal arts. Liberal arts courses and selected professional education courses may be completed at George Washington University or may be accepted for advanced standing from another accredited institution in accordance with regulations on page 108.

Experienced registered nurses and persons engaged in related health services or other human services areas may fulfill the requirements for a B.A. in Education and Human Development in the field of human services by completing 120 credit hours.

General Information for Freshmen and Sophomores

All undergraduates admitted directly to the School of Education and Human Development are assigned academic advisors at the time of admission. Advisors are designated to provide continuity of advising for students throughout their years of undergraduate study. The program for each student must be approved by a faculty advisor.

Since each student's program is defined by individual needs, it is important that students have a clear concept of their major interest in education, and that they be familiar with the certification requirements of those localities in which they expect to teach. Information on state licensing requirements is available in the Career Services Office, located in Woodhull House, 2033 G St., N.W.

Entrance Requirements for Freshmen and Sophomores

Good character and an academic background appropriate for the program of studies contemplated are required.

Requirements for admission to the freshman and/or sophomore years are as follows:

1. An acceptable certificate of graduation from an accredited secondary

school, showing at least fifteen units* which must include four years of English; at least two years of one foreign language; two years of science, preferably with laboratory instruction; two years of social studies, one of which must be American history; and two years of college preparatory mathematics.

2. The principal's statement that the applicant is prepared to undertake college work.

3. College Entrance Examination Board scores submitted on the Scholastic Aptitude Test.

It is recommended that the examinations be taken in December or January of the senior year. Scores on tests taken in the junior year may be submitted. Arrangements for tests are the responsibility of the applicant and should be made with the Educational Testing Service, 20 Nassau St., Princeton, N.J. 08540; or 1947 Center St., Berkeley, Cal. 94704, not less than one month before the date of the test. In applying for the test, the applicant should specify that the scores be sent to the Office of Admissions, George Washington University, Washington, D.C. 20052.

The College Entrance Examination Board tests are preferred; however, the American College Testing battery scores will be accepted. The applicant should request that these scores be sent to the Office of Admissions directly from the American College Testing Program, Iowa City, Iowa. It is recommended that the applicant take the tests in October of the senior year.

The School of Education and Human Development will consider the adequacy of the qualifications of an applicant who, because of unusual circumstances, does not present all of the formal requirements stated above. The School may require appropriate scholastic-aptitude tests. Students admitted with deficiencies in secondary school units will be required to begin removing such deficiencies within the first year, by appropriate courses or examinations.

International students may be considered for admission with an equivalent foreign secondary certificate. A student presenting such a certificate must also show competence in the English language and may be required to enroll in a full-time program in English as a Foreign Language before beginning studies in a degree program. Requirements will be determined on the basis of an English Proficiency Test administered on-campus. A candidate who submits a score of 580 or above on the Test of English as a Foreign Language (TOEFL) may be excused from taking further course work in English as a Foreign Language, but will be required to take the English Placement Examination on campus.

Students who have been out of secondary school for three years or more or do not meet the above requirements may take a special battery of admission tests by contacting the Office of Admissions or may be considered for admission on probation to the School of Education and Human Development. A student admitted on probation is required to complete a trial program of 15 semester hours of course work with a quality-point index of 2.25 or higher. The selection of courses to be taken in the trial program must be made in conference with a faculty advisor.

* A unit represents a year's study in a secondary school subject, including in the aggregate not less than 120 sixty-minute periods, or the equivalent, of prepared classroom work.

Admission with Advanced Standing

Requirements for admission of students transferring from other regionally accredited colleges and universities, and from other divisions of this University, are as follows:

Students who have accumulated 15 hours or more of academic credit at another regionally accredited college or university with an acceptable program and acceptable grades may be admitted to the School of Education and Human Development. Advanced standing may be awarded for properly certified courses taken at regionally accredited colleges or universities for which the student received a grade of *C* or better, and may be applied toward a degree provided that such courses are comparable to the curriculum requirements of the degree at GW.

Although a grade of *D* in a course is not acceptable for transfer, the course may be used to satisfy a curriculum requirement. Credits earned with a *D* grade may not, however, be counted toward advanced standing.

The School reserves the right to refuse credit for transfer in whole or in part or to allow credit provisionally.

It is the responsibility of the student to have an official transcript sent directly from each institution formerly attended to the Office of Admissions, George Washington University, Washington, D.C. 20052.

Students may transfer from another division of this University into a degree program in the School of Education and Human Development. The student must present an accumulated quality-point index of 2.00 or higher at the time of transfer. A student wishing to transfer into the School from another division of this University must submit a formal application of transfer to the Office of Admissions.

Courses taken at another division of this University may be applied toward a degree in this School provided they are comparable to the curriculum requirements of the degree.

Nurses filing for admission to the B.A. program in Human Services are required to submit a copy of their current state nurse's registration (license) in addition to the official transcripts. Nurses may be awarded advanced standing for work completed in a community or junior college program. They may also receive advanced standing up to 30 credit hours for work completed in a two-year teaching hospital program; 45 credit hours may be granted for work completed in a three-year teaching hospital program.

Students applying for transfer from another accredited college or university or from another division of this University whose previous academic records raise doubts of their ability to complete degree requirements successfully may be admitted to the School of Education and Human Development on probation. To be admitted into the School's degree program, a conditionally admitted student must complete a prescribed trial program of 15 semester hours of course work with a quality-point index of 2.25 or higher. A student registered in another division of this University who has an accumulated quality-point index of less than 2.00 and who is conditionally admitted to this School must earn a 2.25 quality-point index in the trial program and must during this trial program bring the accumulated quality-point index to 2.00 or higher to be admitted to the School's degree program.

The selection of courses to be taken in the trial program must be made in conference with a faculty advisor in the School of Education and Human Development. A conference concerning plans for study as a degree candidate is required of each applicant at the beginning and end of the trial program. Upon successful completion of the trial program, the student who has submitted a degree-candidate application will be advanced to degree status.

Requirements for the Degrees

To be recommended for a degree a student must satisfy the admission, residence, scholarship, and curriculum requirements. The amount of course work required for bachelor degrees is as follows: the Bachelor of Arts in Education and Human Development (elementary, middle school, and secondary education, elementary education early childhood education, and special education: complementary teacher program), 126 semester hours; the Bachelor of Arts in Education and Human Development (human services), 120 semester hours; the Bachelor of Science in Human Kinetics and Leisure Studies (dance therapy), 131 semester hours; the Bachelor of Science in Human Kinetics and Leisure Studies (elementary/secondary physical education, dance education, and dance as a performing art), 124 semester hours.

RESIDENCE

Candidates for the bachelor's degree must complete satisfactorily a minimum of 30 semester hours while in the School of Education and Human Development.

DEAN'S LIST

To be eligible for the Dean's List a full-time student must obtain a quality-point index of 3.5 on courses completed during the past semester. A part-time student, to be eligible, must obtain a quality-point index of 3.5 on the last 12 semester hours of course work. Such part-time students must have been enrolled for at least one three-hour course each semester, and residence during the period involved must be continuous.

SCHOLARSHIP REQUIREMENTS

For the system of grading and of computing scholarship, see page 45.

In order to graduate, a student must have a quality-point index of at least 2.25. A quality-point index of at least 2.25 is required before permission is granted to do student teaching in the senior year.

Probation—A student who fails to maintain a quality-point index of at least 2.25 is placed on probation. The student remains on probation as long as the index is below 2.25, or until probation is removed by the Committee on Scholarship.

Suspension—A student on probation who fails to raise the index to 2.25 within the time specified may be suspended.

A student suspended for poor scholarship may, within 10 days, appeal the case through the dean to the Committee on Scholarship. If the case appears to be remediable and the student's scholarship seems likely to improve, the Committee may readmit the student on probation. A student

denied readmission may again, after a lapse of a calendar year, petition the Committee through the dean for readmission. A student suspended twice will not be readmitted.

CURRICULUM REQUIREMENTS

In all bachelor's curricula at least 30 semester hours must consist of courses numbered above 100.

PASS/NO PASS OPTION

A junior or senior student who has a cumulative quality-point index of 2.50 or better, may, with the approval of an advisor and the dean, take one course a semester and receive a grade of *P* (Pass) or *NP* (No Pass) which will be recorded on the student's transcript but will not be reflected in the student's quality-point index. No student will be allowed to take more than four pass/no pass courses. Students must sign up for such an option at registration. Students may change from pass/no pass status to graded status, or vice versa, after the end of registration only with the permission of the dean and the course instructor. Courses required in the student's major field may not be taken on the pass/no pass basis. A transfer student may not choose this option until the second semester of enrollment at this University.

INCOMPLETE/AUTHORIZED WITHDRAWAL

Conditions under which the grades of *I* (Incomplete) or *W* (Authorized Withdrawal) may be assigned are described on page 45.

Removing an Incomplete—When a grade of *I* is assigned, the instructor should normally set a period within which the uncompleted work (usually the final examination or a required paper) must be made up. When required work has been completed, it is the responsibility of the instructor to change the grade of *I*, as appropriate. If work is not completed, the instructor will decide whether to change the grade of *I* to *F*, or to allow the *I* grade to remain. The grade of *I* cannot be removed by reregistering for the course here, or by taking its equivalent elsewhere.

National Teacher Examination

The National Teacher Examination is optional for Education students. Students who take the Examination receive individual reports of test scores and may avail themselves of the regular transcript services of the Educational Testing Service.

Teaching-Field Programs

SUBJECT-AREA SPECIALIZATION

Subject-area specialization depends upon the teaching position for which the student is preparing. Those planning to teach in elementary schools need a degree of competency in several fields. Those preparing to teach in middle schools must acquire competency in a chosen interdisciplinary subject-matter specialization. Those preparing to teach in junior or senior high schools must demonstrate competence in a major teaching field. A minor teaching field is optional, but recommended. The student should begin teaching-field preparation during the first two years.

Teaching-field requirements for secondary education majors, developed in cooperation with appropriate departments of the University, include satisfactory completion of prescribed academic courses in one or more fields and satisfactory completion of the prescribed special methods courses. Prescribed academic courses vary in number in accordance with the scope and complexity of the teaching field and the licensing requirements of the various states.

Professional Education

The basic professional information, skills, and attitudes needed by beginning teachers are provided through a sequence of courses to be taken throughout the four years of undergraduate study. Lectures and class discussions are closely coordinated with field work. Instruction is differentiated to meet the needs of those preparing to teach on the various levels—elementary, middle, junior high, and senior high school.

The prescribed courses in special methods are concerned primarily with methods of initiating, guiding, and evaluating learning experiences dealing with the content of teaching fields. They attempt to bring to the student specific suggestions drawn from the accumulated experience of successful teachers. In addition, the courses review the teaching-field content currently in use in schools.

Education Curriculum

The following is the curriculum for the first two years in preparation for the Bachelor of Arts in Education and Human Development degree with major fields in elementary or secondary education, elementary education/early childhood education, and special education: complementary teacher program.

		Semester Hours
Education/ Special Education:	Educ 101, 102, 103, 104 (for students in elementary and secondary education and the double-major program); SpEd 157, 158, 201, and Educ 102, 104 (for special education majors)	12–15
English:	Engl 9 or 10; 11 or 12; 51–52, 71–72, or 191–92	12
Mathematics:	Math 9 and 10 (for students in elementary education, special education, and the double-major program); two semesters chosen from Math 3, 6, 9, or 10 (for secondary education majors)	6
Science:	Three semesters (two in biological science and one in physical science or vice versa) for students in elementary education, special education, and the double-major program); two semesters for secondary education majors. Courses are to be chosen from BiSc 3–4 or 11–12; Chem 3–4 or 11–12; Geol 1–2; or Phys 1 and 2, or 9–10	6–9
Social Sciences:	Hist 71 or 72 and another social science course (for students in elementary education, special education, and the double-major program); Hist 71–72 or PSc 1 and 2 (for secondary majors)	6

		Semester Hours
	Six semester hours selected from the following: AmCv 71–72; Anth 1–2; Econ 1–2; Geog 1 and 2; Hist 39–40; Hist 71–72; PSc 1 and 2; Soc 1 and 2	6
Speech and Drama:	SpDr 1 or as approved for secondary majors; SpDr 11 for students in elementary education, special education, and the double-major program.	3
HKLS:	For students in elementary education and the double-major program	3
Electives:		0–9
	Total	60–63

Human Kinetics and Leisure Studies Curriculum

Students interested in the Bachelor of Science in Human Kinetics and Leisure Studies with a specialization in elementary/secondary physical education will be admitted to the major in human services to complete the following courses during the first two years and will be admitted to the major in elementary/secondary physical education in the junior year. (Students should begin to acquire competency in several physical activities in the first two years.)

Education:	Educ 102 and 103	6
English:	Engl 9 or 10; 11 or 12; 51–52, 71–72, or 191–92	12
HKLS:	Four semester hours selected from first-group HKLS courses (59, 60, 61, 62 recommended); HKLS 102, 103, 111–12, 130, 139, 150, 151	25
Math/Science:	BiSc 3–4; Chem 3–4; Geol 1–2; Math 9 and 10; or Phys 1 and 2, or 9–10	8
Social Sciences:	Hist 71–72 or PSc 1 and 2	6
	Six semester hours selected from the following: AmCv 71–72; Anth 1–2; Econ 1–2; Geog 1 and 2; Hist 39–40; Hist 71–72; PSc 1 and 2; Soc 1 and 2	6
	Total	64

First two years in preparation for the Bachelor of Science in Human Kinetics and Leisure Studies degree with a specialization in dance education:

English:	Engl 9 or 10 and 11	6
HKLS:	HKLS 107, 108, 150, and 157.	12
	Any combination of dance courses numbered 10–58, 121 or 123	16
Education:	Educ 102, 103	6
Math/Science:	BiSc 3–4; Chem 3–4; Geol 1–2; Math 9–10; Phys 1–2, or 9–10	6
Social Sciences:	Hist 71–72 or PSc 1 and 2	6
	Six semester hours selected from the following: AmCv 71–72; Anth 1–2; Econ 1–2; Geog 1 and 2; Hist 39–40; PSc 1 and 2; Soc 1 and 2	6
Speech and Drama:	SpDr 1, 11, 121 or 169	3
Electives:		3
	Total	64

First two years in preparation for the Bachelor of Science in Human Kinetics and Leisure Studies degree for students interested in dance as a performing art:

		Semester Hours
English:	Engl 9 or 10 and 11	6
HKLS:	HKLS 150, 157	6
	Any combination of dance courses numbered 10–58, 121 or 123	6
Humanities:	Art 21–22, 31–32; Music 1, 3 or 4; Phil 50; SpDr 45	6
Math/Science:	BiSc 3–4; Chem 3–4; Geol 1–2, 5; Math 3, 6, 9, 10; Phys 3, 4, 9, or 10	6
Social Sciences:	AmCv 71–72; Anth 1–2; Econ 1–2; Geog 1 and 2; Hist 39–40, 71–72; PSc 1 and 2; Psyc 1, 5–6, 8, 22, 29; Soc 1 and 2	6
Electives:		24
	Total	60

First two years in preparation for the Bachelor of Science in Human Kinetics and Leisure Studies degree for students in dance therapy:

English:	Engl 9 or 10; 11 or 12	6
Speech and Drama:	SpDr 2, 115, or 121	3
Humanities:	One philosophy, music, or art history course	3
Science:	BiSc 3-4	6
Social Sciences:	Psyc 5, 101, 110, 119, 122; Soc 1; Anth 2	22
Education:	Educ 102 and 103	6
Dance Technique:	Courses chosen from HKLS 10–58; HKLS 121, 123	10
Electives:	Three courses chosen from Psyc 8, 108, 118, 151 are recommended	9
	Total	65

The teaching-field programs and their requirements are as follows:

Elementary Education Program

GENERAL EDUCATION REQUIREMENTS (See pages 111-12)

SUBJECT-AREA SPECIALIZATION

The requirements are three semester hours each, to be selected with approval of the advisor, of art and music survey courses (may be taken on a P/NP basis) and HKLS 122; 9-12 hours of science courses (must include courses in both physical and biological sciences) and 6 hours of social science courses, to be selected with approval of the advisor; Econ 1; Geog 1 and 2; Hist 71 or 72; Math 9, 10. (Some of these courses are listed under the general education requirements above.)

PROFESSIONAL COURSES

Thirty-six credit hours are required, consisting of Educ 105, 110, 111, 112, 128, 135. These courses are in addition to Educ 101, 102, 103, and 104 taken during the first two years.

Special Education: Complementary Teacher Program

GENERAL EDUCATION REQUIREMENTS (See pages 111-12)

SUBJECT-AREA SPECIALIZATION

Same as the elementary education program above, plus Psyc 101.

PROFESSIONAL COURSES

The required courses are SpEd 102, 189, 170, 103, 190, 101, 199, 160, and 168; Educ 110, 112, 118, and 128.

Elementary Education/Early Childhood Education

The general education, subject-area specialization, and professional courses are the same as those required for elementary education. In addition students are required to complete Educ 132, 150, 152, 153, and 154.

Middle School Education Program

The middle school education program offers four teaching-field specializations together with appropriate professional training. While the importance of a thorough understanding of the nature of the middle school learner and the middle school is emphasized, equal stress is placed on early and continued direct experiences in the middle school. This experience culminates in a senior-year block instructional program conducted largely in the field.

GENERAL EDUCATION REQUIREMENTS (See pages 111-12)

SUBJECT-AREA SPECIALIZATIONS

Communications: 30 credit hours
Life Science: 30 credit hours
Earth/Space Science: 30 credit hours
Social Science: 30 credit hours

PROFESSIONAL COURSES

Thirty-six credit hours are required, consisting of Educ 105, 110, 112, 134, 223, a special methods course selected from Educ 136, 137, 138, and 144, and electives planned with an advisor.

Secondary Education Programs

In the secondary education program a number of teaching-field specializations are offered. However, it is strongly recommended that, wherever possible, a candidate undertake the equivalent of a minor in an interdisciplinary subject area. Early counseling by the program advisor is urged to ensure a balanced and realistic program of study. The requirements in the secondary education program are as follows:

GENERAL EDUCATION REQUIREMENTS (See pages 111-12)

SUBJECT-AREA SPECIALIZATIONS

Art—42 credit hours, including Art 1 and 31-32 or 71-72, and two second- or third-group art history courses if open to undergraduates; Art 137; 24 credit hours to be selected from the following: Art 21-22, 23-24, 41-42, 51-52, 57-58, 65-66, 81-82, 123-24, 125-26, 127-28, 131-32, 143-44, 151-52, 153-54, 159-60, 163-64, 166, 179-80, 181, 182, 189-90, 235.

Biology—48 credit hours, including BiSc 11-12; 24 credit hours in upper-level biological science courses; Chem 11-12 and 50.

Chemistry—40-44 credit hours, including Chem 11-12 and 22 or 15-16, 110 or 111, 134, 151-52, 153-54, 191; Math 6, 30, 31; Phys 1 and 2.

Earth Science—49-52 credit hours, including BiSc 3-4; Chem 11-12; Geol 21-22, 101, 111, 125, 151; Math 3 and 6; Phys 1; 6-9 additional credit hours, as approved by the advisor, to be selected from the following: Anth 186; Geol 122, 128, 141, 163, 189.

English—39 credit hours, including Engl 9 or 10, 11 or 12, 52, 71-72, 101, 115 or 117, 127-28; SpDr 11; and nine credit hours to be selected from the following as approved by the advisor: Engl 133-34, 135-36, 153-54, 155-56, 161-62, 163-64, 165-66, 167-68, 171-72, 173-74, 177-78.

French—42 credit hours, including Fren 9, 10, 51-52 or 91-92, 103, 108, 109, 110, and two full-year second-group French literature courses; 6 semester hours from the following: Art 109, 110; Engl 115; a foreign language other than French as approved; Hist 141-42; Psyc 115.

General Science—43-45 credit hours, including BiSc 3-4; Chem 11-12 or 15-16, and 22; Phys 1 and 2 or 9-10; 10 additional credit hours in science as approved by the advisor; 9 credit hours of math to be selected from the following: Math 3, 6, 30, 31, 32, 33.

Geography—24 credit hours, including Geog 1; 3 credit hours selected from Geog 104, 105, 106; 6 credit hours selected from Geog 127, 133, 145, 146, 151, 154, 161; 6 credit hours selected from Geog 2, 124, 125, 140, 141, 143; and 6 credit hours selected from Geog 3, 107, 108, 132, 134, 135, 136, 137, 142.

German—33 credit hours, including Ger 9-10, 51-52, 179-80, and 15 additional credit hours in German as approved by the advisor.

History—42 credit hours, including Hist 39-40 and 71-72; 6 credit hours of a history research seminar; 6 credit hours in each of the three following groups as approved by the advisor: Europe; United States; and Russia, Asia, Africa, and Latin America; 6 additional credit hours as approved by the advisor, in any one of the preceding groups.

Mathematics—39 credit hours, including Math 30, 31, 32, 33, 121, 123 or 124, 135; three additional second- or third-group mathematics courses approved by the advisor; Stat 97, 157-58.

Music—48 credit hours, including Mus 2, 5, 6, 103, 104, 131, 132, 138, 151; 6 credit hours of applied music (voice or major instrument); 12 credit hours of applied music (minor instruments other than major, including piano, voice, guitar); ensemble.

Physics—36 credit hours, including Math 30, 31, 32, 33; Phys 14, 15, 16, 161, 163, 164, 165, 167.

Russian—36 credit hours, including Slav 9-10, 91-92, 109-10, 161-62; 12 credit hours of electives in both language and literature from Slav 101, 103, 104, 109-10, 125, 141, 151, 152, 164, 166.

Social Sciences—42 credit hours, including Econ 1-2; Hist 39-40, 71-72; PSc 1 and 2; 6 credit hours to be selected from the following: Anth 1-2; Geog 1, 2; Soc 1, 2; plus 12 credit hours of second-group courses as approved by the advisor, from anthropology, economics, geography and regional science, history, political science, and sociology.

Spanish—42 credit hours, including Span 9-10, 51-52 or 91-92, 109-10 three full-year courses selected from second-group Spanish or Spanish-American literature courses; 6 credit hours to be selected from the following: Engl 115; a foreign language other than Spanish as approved; Hist 161, 163-64, 165, 166; Psyc 115.

Speech and Drama—39 credit hours, including SpDr 1, 11, 32, 45, 49, 101, 103, 112, 121; plus 12 credit hours to be selected from speech communication, drama, or radio-television courses, as approved by the advisor.

PROFESSIONAL COURSES*

The requirements are 21 to 27 credit hours, consisting of Educ 105, 223 (for undergraduate credit), 112, 131, 134 (6-9 credit hours), and 3 credit hours selected from Educ 136, 137, 138, 139, 140, 144, 146. These courses are in addition to the following courses, usually completed during the first two years: Educ 101, 102, 103, 104.

Bachelor of Science in Human Kinetics and Leisure Studies

The program, which is designed to prepare students for teaching in elementary and secondary schools, offers opportunities for specialization in dance education and elementary/secondary school physical education. Programs are also offered in dance as a performing art and dance therapy for persons not interested in certification for teaching.

Prerequisite—For the first two years of the Bachelor of Science in Human Kinetics and Leisure Studies curriculum, see pages 115-16.

Specialization in Dance Education, junior and senior years—The following courses are required: Educ 104, 105, 112; HKLS 109-10, 117, 119, 133, 135-36, 137, 141-42, 144, 150, 151, 175, 200; plus 9 credit hours of electives.

Specialization in Dance as a Performing Art, junior and senior years—The requirements consist of 20 credit hours selected from HKLS 10-58, 122, or 123; and HKLS 108, 109-10, 120, 135-36, 137, 141-42, 144, 173, 175; plus 9-11 credit hours of electives.

Specialization in Dance Therapy, junior and senior years—10 credit hours selected from HKLS 10-58; HKLS 106, 107, 108, 109, 110, 113 or 114, 117, 119, 120, 136, 137, 141, 142, 144, 150, 157, 173, 175, 184.

Specialization in Elementary/Secondary Physical Education, junior and senior years—Sixty credit hours are required: SpDr 1 or 11; Educ 104, 105, 112; HKLS 113, 114, 129, 138, 158, 164, 171, 133; plus 12 hours of an HKLS area of concentration and nine hours of electives.

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* A course in the teaching of reading is recommended since it is required for employment in many jurisdictions.

Bachelor of Arts in Education and Human Development—Program in Human Services

The program in Human Services is designed for personnel in the following representative types of human service fields: nursing, gerontology, mental health, criminal justice, etc.

The program in Human Services is planned to: (1) enable individuals to develop their cognitive and affective abilities; (2) meet a range of human services needs; (3) develop human interaction and leadership skills; (4) facilitate entry into or advancement in human services occupations; (5) gain an awareness and appreciation for interacting values in a pluralistic society; and (6) prepare for graduate study in a professional field.

The program features a variety of fieldwork and classroom lectures, seminars, and consultation. Opportunities are provided for acquaintance with diverse human service settings and professionals in the field, and for academic concentration in departments throughout George Washington University.

Programs for students will be individually planned after an evaluation is made of previous professional and educational experiences and long-range goals.

Advanced standing may be awarded for liberal arts and specialization courses completed at accredited colleges and universities. Advanced standing will be granted for registered nurses who have completed two- or three-year programs at accredited teaching hospitals—30 credit hours for two-year programs and 45 credit hours for three-year programs. Credit will be recognized for courses completed in the sciences, but not in the other liberal arts.

Students will be required to complete the following liberal arts requirements for the degree either in previous work at another accredited institution of higher education or at George Washington University.

		Semester Hours
English:	Engl 9 or 10 and 11; 51 or 52	9
Mathematics:	Math 9 or 10	3
Psychology:	Psyc 1	3
Science:	BISc 3, 4; Chem 3, 4; Geol 1, 2; Phys 1, 2; Phys 9, 10	6
Social Sciences:	Hist 71–72; PSc 1, 2; Anth 1–2; Soc 1, 2; Econ 1–2; Geog 1, 2	6
Speech and Drama:	SpDr 1, 11, or 111	3

Core courses include Educ 101, 102, 103, 104, 105, 124, 133 or SLP 152, and nine additional credit hours to be chosen in consultation with the advisor.

Concentrations of 12 to 24 hours may be selected in the following fields: administration; adult education/human resource development; consumer affairs; early childhood education; mental health; early childhood special education; therapeutic recreation; travel and tourism; and vocational special education. In addition to the concentrations listed, degree candidates have the option of designing an area of concentration in other divisions of the University in consultation with the academic advisor.

GRADUATE STUDY

The School of Education and Human Development offers graduate programs leading to the degrees of Master of Arts in Teaching, Master of Arts in Education and Human Development, Education Specialist, and Doctor of Education.

GRADES

For graduate work, grades are indicated as *A*, Excellent; *B*, Good; *C*, Minimum Pass; *F*, Fail; *I*, Incomplete; *IP*, Progress; *W*, Authorized Withdrawal; *Z*, Failure, Unauthorized Withdrawal; *CR*, Credit. Grades *A*, *B*, *C*, and *F* are counted in computing the quality-point index (see page 46).

Whenever a grade has not been assigned, the symbol *I* (Incomplete) or the symbol *W* (Authorized Withdrawal) will be recorded. The symbol *I* indicates that a satisfactory explanation has been given to the instructor for the student's failure to complete the required work of the course. An instructor recording a grade of *I* will normally stipulate a date by which work must be completed. The instructor has the responsibility for changing the grade of *I* to an appropriate grade upon completion of work, or, if work is not completed by the stipulated date, determining whether the grade of *I* should be changed to *F* or allowed to remain in the record.

THE DEGREE OF MASTER OF ARTS IN TEACHING

The School of Education and Human Development offers an intensive interdisciplinary fifth year in museum education. This program is designed to prepare selected liberal arts graduates, postgraduates, and professionals for education work in a museum or for liaison work between museums and school systems. Students receive the degree of Master of Arts in Teaching upon completion of the program.

For details write the chairman of the Department of Education, M.A.T. Program, School of Education and Human Development, George Washington University, Washington, D.C. 20052.

ADMISSION

To be admitted to the program in museum education an applicant must (1) have a bachelor's degree from an accredited institution; (2) submit three written references attesting to quality of academic record and work experience; and (3) be interviewed by the University Selection Committee or make alternative arrangements specified by the Committee and approved by the dean of the School of Education and Human Development. Considered essential are skills in communication, a desire to study and learn from the artifacts of nature and civilization, and an ability for and interest in working with people. Evidence of strong undergraduate, graduate, or professional experience in such fields as American history, geology, art, or the social sciences will be considered favorably.

PLAN OF STUDY FOR THE MUSEUM EDUCATION PROGRAM

The program begins with a six-week summer session. Emphasis is on the study of museums and communication skills. During the fall semester students study the school as an institution—its organization, pupil population, staff and services—and as a laboratory, where they will work in class-

rooms with students and teachers. The program will also focus on other museum audiences. Students will earn at least 12 semester hours of credit in an academic concentration. During the spring semester students will have an internship in area science, art or history museums.

THE DEGREE OF MASTER OF ARTS IN EDUCATION AND HUMAN DEVELOPMENT

Programs of study leading to the degree of Master of Arts in Education and Human Development are designed to enable prospective teachers and experienced teachers to increase their professional and academic knowledge and skills and to prepare for special types of educational service. They also provide opportunities for college graduates in other disciplines to acquire needed professional education, as well as study in the subjects which are directly related to their professional objectives.

Master's programs are available in the fields listed on the following pages.

Adaptive Physical Education

The primary goal of the adaptive physical education degree program is to make a contribution toward alleviating the shortage of trained personnel in physical education for handicapped persons. The program also serves to retrain physical educators for new roles in public school systems and developmental and rehabilitation settings. The program focuses upon the adaptive physical educator as part of the comprehensive treatment team; therefore a multidisciplinary approach is emphasized.

Adult Education

The program of study in the field of adult education prepares students for positions in educational institutions, voluntary organizations, and other institutions in the private or public sectors which sponsor adult learning programs. The students enrolled in this program obtain the skills and understandings required to perform functions associated with the roles of learning specialist, administrator, counselor, and consultant in the field of adult education.

College Student Development

The master's degree program in college student development provides the academic, professional, and philosophical preparation for entry-level positions in the field of student affairs. The program provides education in administration, counseling, group facilitation, leadership training, and organizational development. Many graduates are employed in colleges and universities in the areas of career development, international student advising, residence hall programming, financial aid, student affairs research, student activities, admissions, and counseling.

Community Counseling

The community counseling program prepares individuals to do vocational, educational, or personal counseling in community or governmental agencies.

Curriculum

The master's degree program in curriculum has been developed to assist educators in meeting state licensing requirements for school administration and supervision. Courses cover a broad range of theory and practice and are appropriate for non-school-based agencies and for educators concerned with program or learning media development.

Dance

The master's degree program in dance is designed to prepare dance specialists for roles in the areas of choreography, therapeutic dance, dance education, performance, or for specific areas of specialization, i.e. criticism history, research. The student plans with the advisor a course of study that considers individual background, professional interests, and career goals. Students from a variety of disciplines are accepted into the degree program.

Early Childhood Education

The master's degree program in early childhood education prepares teachers, directors, and supervisors in nursery schools, day care centers and kindergartens, as well as researchers and program specialists in the field.

Education and National Development

This program of studies helps develop individual skills and competencies for organizational leadership or leadership support in our rapidly changing society. It provides a core of professional course work, along with competency-based electives, seminars, and internships in federal, state and local agencies. The program is intended for active and developing leaders in education and related fields in government, institutions, organizations, business, or industry who desire to understand and operate effectively in policy development or policy development support areas.

Elementary Education

The master's degree program in elementary education is planned to help teachers continue their professional growth and advance in competence in their work in regular elementary school classrooms. The program may be used to develop an academic specialization for work with elementary school children, or to explore fields of specialization for present or future professional goals.

Elementary/Secondary Administration

The graduate program in educational administration is designed to prepare students for leadership roles in public and private educational organizations. The master's degree program in elementary and secondary administration is considered to provide the minimum entry-level preparation for the positions of principal, assistant principal, and head of department.

Exercise Science

This program is designed to prepare the student to assess physical fitness, prescribe therapeutic activities, conduct exercise programs, and evaluate

program effectiveness. Placement opportunities for graduates include occupational health and fitness programs, health spas and clubs, government agencies, and business and industrial programs.

General Physical Education

This program permits students to take courses in allied areas and cognate fields to enhance their ability to compete for more varied employment opportunities in general physical education. The electives are planned by the student in consultation with the advisor and are based on background and professional goals.

Gifted and Talented

This program is planned to help students to prepare themselves in a comprehensive and research-based manner to teach gifted and talented individuals; to design programs and prepare appropriate instructional strategies and materials for the gifted and talented; and to supervise or administer programs for the gifted and talented. Graduates will be prepared to work with gifted and talented individuals at a self-selected level, ranging from early childhood through adulthood.

Higher Education

The higher education program affords the student a concentration in administration, teaching, or curriculum. Courses prepare students for administrative positions in areas generally encompassing college and university organizations: academic affairs, public relations, finance, and development.

Human Resource Development

The program of study in the field of human resource development is designed for persons either entering or advancing in positions associated with training, education, and development activities in business, industry, government, and other large organizations in the public or private sectors. The program prepares students with the skills and understandings needed for responsibilities as learning specialists, administrators, and consultants in this field.

Individualized Master of Arts

This program permits development of individualized programs which cut across existing fields, both within the School of Education and Human Development and between Education and other schools and departments of the University and Consortium. The program is designed to meet specific professional objectives of applicants with unique needs. It will be possible to relate independent study, special workshops, international experiences, and a thesis to identified objectives. There must be a balance between foundational and specialty preparation and between theoretical and practical experiences.

International Education and Human Resource Development

This program is designed for persons either entering or advancing in positions associated with training, education, and development activities in business, industry, government, and other organizations that require

international understanding. Program content is based on the learning systems of other peoples and cultures as each reflects values, mores, customs, and current problems, thus helping the student develop a global frame of reference.

Perceptual-Motor Development

The purpose of this program is to assist the student in developing the ability to observe performance, analyze tasks, assess developmental level, prescribe appropriate activities, and apply appropriate learning strategies. Graduates are now working as motor development specialists and team members in special education settings, resource personnel for mainstreaming, curriculum specialists in movement education and perceptual-motor development, and activity coordinators in public and private day care centers.

Program Evaluation

This interdisciplinary program prepares individuals for careers as program evaluation professionals. Work settings include such fields as education and training, public health, criminal justice, employment, and welfare and human services. Opportunities exist in the federal and state governments, non-profit institutions, and other public and private agencies conducting evaluations of social and human services programs.

Reading

Teachers who have completed this program have been employed in various school systems, as special reading teachers, reading clinicians, reading consultants, or reading supervisors. Persons who complete the program (or courses selected from it) will be more attractive candidates for regular classroom teaching positions, in addition to being more effective teachers

Rehabilitation Counseling

This program prepares individuals to provide counseling and psychosocial services to people with physical, emotional, intellectual, or social disabilities. Employment opportunities exist in state rehabilitation agencies, sheltered workshops, rehabilitation centers, mental health settings, industry, and other settings in the private sector.

School Counseling

The school counseling program prepares individuals to be certified to work as counselors in elementary or secondary schools.

Secondary Education

This program is designed primarily for junior and senior high school teachers who wish to further develop their skills and competencies in teaching. The program is also useful to those interested in learning about secondary schooling in the United States.

Special Education

Early Childhood Special Education

The early childhood special education program consists of 39 semester hours of graduate credit designed to bring students insight and knowledge

in the areas of the development of young exceptional children; handicapping conditions of early childhood; identification and assessment procedures in early childhood special education; clinical teaching of developmentally disabled young children; and alternative models of service to the developmentally disabled young child. This two-pronged program prepares teachers of developmentally disabled young children (a direct service role), and early childhood special education strategists (a consultant role). Admission requirements differ for each role. Eligibility for this program is best determined by a personal interview with the program staff.

Liaison Special Educator/Parent Educator

This is a non-teaching special education program preparing professionals with the expertise to provide leadership and liaison services in the integration of special education, health, and social services for the handicapped child and his or her family.

Psychoeducators of the Seriously Emotionally Disturbed Adolescent

This is a multidisciplinary program blending course work and clinical experiences for preparing special educators who serve the severely disturbed adolescent within the multidisciplinary/interagency team context. With the majority of training provided within the Special Education Department, graduate students are also involved in course work and/or clinical experiences with the Education, Health Services Administration, Psychiatry and Behavioral Sciences, Psychology, Sociology, and Speech and Drama Departments.

Vocational/Special Education

This program is designed to provide trained personnel to assist the handicapped to become self-sufficient in an increasingly complex society. The emphasis of the program has been placed on career training in order to assist the handicapped person to obtain a constructive place in the working community. The student receives intensive training in assessment, individual educational planning, pre-vocational education, supportive-vocational education, academic programs, and community placement. A graduate of this program will be prepared to be either a *classroom-based* teacher in a secondary-level school, serving as a work-study coordinator or special education classroom teacher, or a *school-based* resource teacher.

Supervision and Human Relations

The program in supervision and human relations prepares persons for administrative and supervisory positions in public and private schools and school districts. The program is designed to lead toward licensing for administrative and supervisory positions in nearby states. Basic courses relate to general supervisory principles and responsibilities, and will also be of interest to educators in non-school agencies.

Therapeutic Recreation

The program prepares students for positions in therapeutic recreation in hospitals, institutions, day care centers, geriatric facilities, community recreation departments, and other facilities which provide services to

special populations. At least seven roles have been identified in the field of therapeutic recreation: these include therapist, counselor, educator, supervisor, administrator, researcher, and consultant.

Tourism Development and Travel Administration

The program has an emphasis that is international in scope; it is concerned with public travel and tourism offices, convention and visitor bureaus, research and planning firms, financial institutions, tour wholesalers, travel agencies, educational institutions, and corporations involved in travel and tourism. The program is intended for those concerned with developing competencies needed for advancement in tourism and travel organizations, and with preparing entry-level professionals for placement. Graduates are now employed by travel-related businesses, colleges and universities, national tourism agencies, resorts, and in other travel/tourism organizations.

ENTRANCE REQUIREMENTS FOR THE MASTER OF ARTS IN EDUCATION AND HUMAN DEVELOPMENT

A bachelor's degree from an accredited institution and an undergraduate quality-point index of 2.50 or above (C+ average) are required. Students whose quality-point index is in the range of 2.3 to 2.49 will be considered for provisional admission. The quality-point index is computed on the basis of the last two years of the bachelor's degree program and on all course work completed beyond the baccalaureate.

Two years of successful teaching are required before admission to candidacy in the field of elementary/secondary administration. Experience may be required for admission to programs in adult education and human resource development.

Candidates whose undergraduate preparation does not include equivalents of the basic requirements for the degree of Bachelor of Arts in Education must make up deficiencies and may be required to take designated tests.

An interview in the office of the dean is required for applicants who live in the Washington, D. C., metropolitan area; a letter of reference is required of all other applicants.

ADVANCED STANDING

Advanced standing is granted for approved courses taken at other accredited institutions, but a minimum of 24 semester hours must be completed at this University as a master's candidate.

A maximum of 12 semester hours of advanced courses completed in this University in excess of the requirements for the bachelor's degree may be credited toward the master's degree if the work fits in with the student's plan of specialization.

Advanced standing is not granted for work completed five or more years before application for admission or readmission to master's candidacy.

PLAN OF STUDY

The plan of study leading to the degree of Master of Arts in Education and Human Development requires a minimum of 33 hours of graduate credit. The plan may, at the student's option, include a thesis carrying six

hours of graduate credit. Whether or not a student selects the thesis option, a minimum of 18 hours must be from courses planned primarily for graduate students (third-group courses). A minimum of 12 hours, not including the thesis, must be from courses offered by the School of Education and Human Development.

Programs are planned initially in conference with an admission advisor in the School of Education and Human Development and subsequently with a designated advisor in the candidate's area of specialization. Programs are based on a candidates' interests and background; those related to teaching in public schools are designed around certification requirements of the state and locality in which the candidate plans to teach.

All degree requirements must be completed within six years.

RESIDENCE

A candidate for the master's degree is required to complete satisfactorily 24 semester hours in residence.

SCHOLARSHIP

A quality-point index of 3.00 is required for graduation. Students who receive the grade of *C* in more than six semester hours are subject to suspension. Students who receive a grade of *F* must confer with the dean **before enrollment for further work.**

THE THESIS

The choice of the thesis subject must be approved in writing by the student's advisor and filed in the office of the dean. A statement of the School of Education and Human Development standards for the thesis and printed copies of detailed regulations regarding the form and reproduction of the thesis are available in the office of the dean.

Payment of tuition for the thesis course entitles the candidate, during the period of registration, to the advice and direction of the member of the faculty under whom the thesis is to be written. In case a thesis is unfinished, additional time may be granted. The student must, however, be enrolled continuously in the program. If the preparation of the thesis extends beyond the additional time granted, the student must register for the entire six hours of thesis again and pay tuition as for a repeated course.

MASTER'S COMPREHENSIVE EXAMINATION

Candidates in M.A. programs requiring 33 semester hours may, with the approval of their academic advisors, elect to take an additional three-semester-hour course in lieu of a comprehensive examination. Candidates in programs whose basic requirements exceed 36 semester hours may waive the comprehensive examination with approval of the academic advisor. **Candidates who plan to take the examination must be registered** in the semester it is to be taken and must file a written application in the office of the School of Education and Human Development no later than 30 days prior to the date of the examination. Comprehensive examinations **are required of students in Early Childhood Education, College Student Development, Gifted and Talented, Reading, and all programs in Human Kinetics and Leisure Studies.**

WORK IN OTHER ACADEMIC DEPARTMENTS

For teachers interested in developing or strengthening their academic competence, the Master's programs in elementary and secondary education normally permit 15 to 18 semester hours of work in departments other than education. These programs are designed to meet the need of teachers-in-service who need additional work in content to qualify for advanced certification or to improve their classroom skills and may also be helpful to previously trained teachers planning to re-enter the profession. The major emphasis is upon strengthening both academic and professional competencies.

SECOND MASTER'S DEGREE

Persons seeking a second master's degree in the School of Education and Human Development must complete all core and specialization requirements and a minimum residency requirement of 24 semester hours.

THE DEGREE OF EDUCATION SPECIALIST

The program of advanced study leading to the degree of Education Specialist is for students with master's degrees in education who seek further professional preparation for specific objectives.

Education Specialist programs are available in the fields of administration, adult education, counseling, curriculum, higher education, and human resource development.

Entrance Requirements

The degree of Master of Arts in Education and Human Development, or equivalent; two years of pertinent experience in education; a graduate scholastic average of at least 3.3 or a 50th percentile score on the Graduate Record Examination or Miller Analogies Test are required. A score on one of the specified tests must be submitted as part of the admission procedures.

Each applicant must be interviewed and recommended by a faculty advisor in the major field who will submit a tentative program plan prior to admission.

Scholarship

Scholarship requirements for the degree of Education Specialist are the same as those for the degree of Master of Arts in Education and Human Development (see above).

Programs of Study and Degree Requirements

Individual programs are developed, through the faculty-advisor plan, to fit the candidate's skills, interests, and career goals. A minimum of 30 semester hours beyond the requirements of the degree of Master of Arts in Education is required. At least 21 hours of this work must be taken on campus at this University; with the approval of the advisor, the remaining semester hours of the program may be taken in off-campus offerings

of the GWU Division of Continuing Education and Summer Sessions or at another approved university. A maximum of five calendar years is allowed for completion of the program.

At least 12 of the required 30 hours must be in appropriate graduate courses in education selected from the following areas: (1) foundations and cognate study, (2) background and general principles of the field of study, (3) an area of specialization.

The Comprehensive Examination

Successful completion of a six-hour written examination and/or an oral examination, at the option of the major field advisor, is required.

THE DEGREE OF DOCTOR OF EDUCATION

The School of Education and Human Development offers programs of advanced study leading to the degree of Doctor of Education. These programs, which are under the supervision of the Advanced Graduate Faculty, provide major fields of study in teacher education, special education, counseling, administration and curriculum, adult education, human development, human resource development, and higher education. Supporting fields are available in administration, administration of higher education, adult education, college student development, counseling, curriculum, elementary education, higher education, human growth and development, human resource development, international education, reading, secondary education, special education, supervision, teacher education, and tourism development and travel administration. With the approval of the Advanced Graduate Faculty and the departments concerned, one supporting field may be taken in other departments of the University. All programs require study of interrelated areas of education and a doctoral dissertation in the major field of study.

Admission

The applicant must have adequate preparation for advanced study, including graduate work in fields prerequisite to his or her objective, equivalent to that required for the degree of Master of Arts in Education at this University, at least three years of successful pertinent educational experience, acceptable personal qualities, and a capacity for creative scholarship and effective leadership.

The applicant first arranges for an interview with the assistant dean to explore the applicant's needs in relation to the resources of the School and to guide the student in applying for doctoral study. The required procedures and standards will be explained at this time. Candidates meeting the initial standards are admitted to precandidacy for the degree.

PRECANDIDACY

In the precandidacy period a minimum of nine semester hours of course work in the program, including requirements specified by the Advanced Graduate Faculty, must be completed. This work must be completed within three semesters of admission to precandidacy, for part-time students, or within the first 18 semester hours of course work for full-

time students. Application for full candidacy will then be decided on the basis of the quality of scholarship in the precandidacy period, the recommendations of instructors, a detailed plan for the balance of the program, and a qualifying examination.

Plan of Study

In general, from two to three years of full-time study beyond the degree of Master of Arts in Education, or the equivalent in part-time study, are required. Programs are individually planned. It is estimated that, for the average student, the work required for the total program will be 75 semester hours, including a minimum of 12 semester hours of dissertation research.

Each program is divided into two parts. The first consists of preparation for comprehensive examinations in a major field of study and two supporting fields, and completion of a required research tool field. The second is composed of research investigation, the writing of a dissertation, and the final oral examination.

Students who have completed the comprehensive examinations must register for a minimum of six semester hours of *Dissertation Research* (Educ 491) per semester until 12 hours have been completed, and a minimum of three semester hours a semester thereafter, up to a total of 24 semester hours, until the satisfactory completion of the final examination.

COMPREHENSIVE EXAMINATIONS

Upon admission to doctoral candidacy the student is assigned to a committee, each member of which is responsible for guiding the preparation for one of the required comprehensive examinations in supporting fields or the major field comprehensive examination. The candidate must arrange individual conferences with the committee members to determine the content of each field and to receive guidance in preparation for the examination.

The supporting field examinations, which are taken first, are three-hour written examinations. In addition to the research tool field a student who plans a historical research investigation for the dissertation may be required to complete an appropriate research seminar offered by the Department of History. The tool requirement must be completed prior to the major field examination. The major field examination is a written 12-hour examination, six hours on each of two successive days.

The candidate begins the second part of the program after the satisfactory completion of all supporting field examinations, the required research tool field and the major field examination.

THE DISSERTATION

A dissertation is required as evidence of ability to perform scholarly research and to interpret and present its results.

During the first part of the program, the dean appoints a dissertation committee, consisting of a chairperson (usually a major field advisor) and two additional faculty members. The candidate is required to submit a proposal for the dissertation to this committee, which determines its acceptability. The dissertation is completed under the guidance of the chair-

person, with the advice of the other members of the dissertation committee.

No later than the date specified in the calendar, the candidate must submit to the dean five complete copies of the dissertation and two copies of an abstract for inclusion in the announcement of the examination and for reproduction by University Microfilms, Inc. Printed copies of detailed regulations regarding the form and reproduction of the dissertation, preparation of the abstract, and services offered by University Microfilms, Inc., are available in the office of the dean. The successful candidate for the doctorate is required, before receiving the degree, to pay a fee to cover the expense of printing the Announcement of the Final Examination and to cover the basic service rendered by University Microfilms, Inc., and to sign a microfilm agreement.

THE FINAL EXAMINATION

When the dissertation has approval of the director, the candidate is recommended to the dean for the final oral examination, which must be passed at least three weeks before the degree is to be conferred. The examination is open to the public and is conducted by a committee of the faculty, appointed by the dean, supplemented by at least two leaders in the candidate's field of study from outside the University. Candidates who successfully pass the oral examination are recommended for the degree by the faculty of the School of Education and Human Development.

Residence and Continuous Study

All the preparation for the degree, including examinations, courses, seminars, and other work done under the direction of an advisor, must be done in residence. The student must be continuously enrolled in the School of Education and Human Development, unless the dean or the Advanced Graduate Faculty grants a leave of absence. Failure to register each semester of the academic year may result in lapse of candidacy. Subsequent readmission is subject to whatever new conditions and regulations have been established by the Advanced Graduate Faculty.

The supporting and major field examinations must be completed within five years of the date of admission, and the entire program must be completed within eight years, regardless of full-time or part-time study. All candidates must satisfy one of three options for full-time study. Information concerning these plans will be provided by the assistant dean upon request by the candidate.

SPECIAL PROGRAMS AND SERVICES

Graduate, Undergraduate, and Non-degree Training of Personnel Serving the Handicapped

The School of Education and Human Development offers various programs for the education of personnel serving the handicapped. Field-based training experiences are arranged throughout the metropolitan area. Students are accepted at the undergraduate, master's, and doctoral levels. Regular education and special education teachers and school administrators, as well as students from other schools and colleges at the University, may elect these courses. Inquiries concerning the programs and

the availability of federal awards should be directed to Dr. Rita Ives, Department of Special Education, George Washington University, Washington, D.C. 20052.

Graduate Program in Rehabilitation Counseling

This federally funded master's degree program trains rehabilitation counselors to assist those who are disabled or disadvantaged to assume a place in society. The 51-credit-hour program combines fieldwork and coursework in preparing students for employment in an expanding field that yields high humanitarian rewards. Both the profession and the program are interdisciplinary, drawing upon such related areas as guidance, medicine, psychology, social work, sociology, and special education.

Inquiries concerning the program, the availability of traineeships for full-time students and applications should be directed to Dr. Donald Linkowski, Rehabilitation Counselor Education, George Washington University, Washington, D.C. 20052.

Graduate Specialization in Therapeutic Recreation and Adaptive Physical Education

This master's degree program in the field of physical education, with a specialization in therapeutic recreation or adaptive physical education, is funded by the Bureau of Education for the Handicapped, U.S. Department of Education. Inquiries concerning the program and the availability of graduate research assistantships and internships should be directed to the Chairman, Department of Human Kinetics and Leisure Studies, George Washington University, Washington, D.C. 20052.

Therapeutic Recreation Technician Certificate Program

The Department of Human Kinetics and Leisure Studies offers a certificate program in therapeutic recreation. This prototype technician program trains paraprofessional personnel to work in a variety of settings, such as community recreation, state institutions, correctional facilities, and nursing homes. The curriculum emphasizes the therapeutic recreation process and activity leadership skills. Students who complete the program will qualify for professional registration with the National Therapeutic Recreation Society. Students in the Human Services Program may participate in this program as an area of concentration in therapeutic recreation. Inquiries should be addressed to Ms. Andrea Morris, Department of Human Kinetics and Leisure Studies, George Washington University, Washington, D.C. 20052.

Certification Curricula

The School of Education and Human Development provides individually planned programs for liberal arts graduates with appropriate degrees from accredited institutions who wish to prepare for teaching. Those seeking certification, but not wishing to work for a degree, may enroll in a certification program if they meet the admission, scholarship, and personality requirements of degree candidates. The School also provides a wide range of courses of interest to teachers who wish to renew licenses.

Reading Center

(See page 53)

Off-Campus Degree Programs

The School of Education and Human Development offers off-campus programs leading to the degree of Bachelor of Arts in Education and Human Development in the field of human services and the Master of Arts in Education and Human Development in the fields of adult education, elementary education, higher education, human resource development, reading, secondary education, special education/early childhood, vocational special education, and supervision and human relations. The degree of Education Specialist is offered in administration and higher education. The programs are coordinated through the Division of Continuing Education and Summer Sessions.

SCHOOL OF GOVERNMENT AND BUSINESS ADMINISTRATION

Dean N.M. Loeser
Associate Dean L. Gintzig
Assistant Deans J. Lobuts, Jr., P.B. Malone III

FACULTY 1981-82*

Professors E.B. Adams, F. Amling, N. Beckman, P.S. Birnbaum, G. Black, D.S. Brown, B. Burdetsky, S.R. Chitwood, K.J. Darr, M.C. Devolites, S.F. Divita, R.F. Dyer, R.B. Eastin, A. El-Ansary, R.W. Eldridge, R.F. Ericson, S.S. Fuller, M.G. Gallagher, L. Gintzig, P.D. Grub, W.E. Halal, W.C. Handorf, M.M. Harmon, J. Hilmy, J. Harvey, W.J. Keegan, F.C. Kurtz, G.P. Lauter, E.J.B. Lewis, G.L. Lippitt, N.M. Loeser, A.J. Mastro, D.C. McGrath, Jr., H.R. Page, C.M. Paik, P.N. Reeves, D.D. Roman, J.B. Spain *(Visiting)*, P.B. Vaill, J. Zwick

Associate Professors W.C. Adams, W.H. Becker *(Visiting)*, J.H. Carson, B.L. Catron, J.P. Coyne, H.J. Davis, E.H. Forman, J.D. Frame, F. Ghadar, L. Graff, S. Greene, E.W. Hahn, W.W. Hardgrave, R.L. Holland, E.L. Hullander, J. Lobuts, Jr., P.B. Malone III, J.F. McCarthy, Jr., A.E. Merget, Y.S. Park, J.N. Pearce, J.M. Sachlis, S.N. Sherman, R.G. Shouldice, R.M.F. Southby, S.J. Tolchin, L.H. Truong, S. Umpleby, C.W. Washington, E.K. Winslow

Assistant Professors T.M. Barnhill, D.F. Bergwall, M.H. Bowers, W.D. Breneman, J.R. Carey, N.G. Cohen, B.E. Committe, G.E. Crum, M.J.

* The President of the University, the Vice President for Academic Affairs, the Registrar of the University, the Director of Admissions of the University, and the University Librarian are ex officio members of the Faculty of the School of Government and Business Administration.

Enders, D. Gale, W.D. Greaf *(Research)*, M.E. Hatcher *(Visiting)*, D.R Kane, M.S. Katzman, Y. Lee *(Visiting)*, M.L. Liebrenz, S.D. Lind, L.M Maddox, W. Margrabe, C.P. McKelvey, D.J. Moon *(Research)*, K. Newcomer, P.S. Peyser, F.J. Rooney, D.R. Sheldon, J.B. Thurman, G.C. Wooding

Instructors D. Gray, N. McDermott, J.A. Talbot, G.B. Wright

Committees*

DEAN'S COUNCIL

M.C. Devolites, S. Green, E.W. Hahn, W.C. Handorf, F.C. Kurtz, S.J. Tolchin

COMMITTEE ON CURRICULUM AND PROGRAMS

G. Black, D.E. Gale, L. Gintzig, L. Graff, A.J. Mastro, A.E. Merget, R.G. Shouldice

COMMITTEE ON DOCTORAL STUDIES

T.M. Barnhill, S.R. Chitwood, S.S. Fuller, W.W. Hardgrave, S.D. Lind, A.J. Mastro, S. Umpleby

COMMITTEE ON MASTER'S STUDIES

K.J. Darr, R.F. Dyer, M.M. Harmon, J.F. Lobuts, D.C. McGrath, Jr., C.M. Paik, D.O. Porter, P.B. Vaill

COMMITTEE ON UNDERGRADUATE STUDIES

A.I. El-Ansary, D.R. Sheldon, J.Y. Ruth, W.E. Smith, C.P. McKelvey, P.B Malone

INTRODUCTION

This School was organized as the School of Government in 1928. During the next two decades, programs in business administration and public administration were added, and the emphasis gradually shifted from undergraduate to graduate study. The name was changed in 1960 to the School of Government, Business, and International Affairs to reflect more accurately the offerings of the School; in 1966 the School of Government and Business Administration was established.

Purposes

The School of Government and Business Administration is dedicated to academic excellence through the study, teaching, and research of management and policy in the public and private sectors, both within the United States and internationally.

Over a span of half a century, the School of Government and Business Administration has developed a learning community in which mature individuals can prepare themselves to assume membership and leadership roles in society. The School practices a multi-disciplinary approach with flexibility in educational programming in the belief that such is essential to dealing with the complexities of today's organizational society. The School offers preparation of both the generalist and the specialist for professional

* The Dean of the School is an ex *officio* member of all committees.

careers, and seeks to improve the quality and character of the individual as citizen, professional, and scholar as well.

More specifically, the purposes of the School are:

1. To prepare its graduates for positions in the management of complex organizations.
2. To provide a broad and fundamental education as preparation for positions carrying management and leadership responsibilities.
3. To provide specialized educational opportunities as preparation for career positions in professional disciplines or functional areas.
4. To explore in all their forms, through education and research, the content, interactions, and interdependencies of disciplines and institutions in the public and private sectors, both nationally and internationally.
5. To make available the School's resources to business, health, government, community, and other organizations in both the metropolitan area and the larger community.
6. To foster understanding and advancement of knowledge and skills in the world community through research, education, and scholarly exchange with governments, institutions, and organizations engaged in the solution of international trade and investment problems, and the management of human settlements.

Academic Status

The School of Government and Business Administration has maintained full membership in the Middle Atlantic Association of Colleges of Business Administration since 1961. It joined the Council on Graduate Education for Public Administration in 1966. In 1968, the School became a member of the American Assembly of Collegiate Schools of Business, and the undergraduate programs are accredited by the Assembly. The program in health services administration is accredited by the Accrediting Commission on Education for Health Services Administration. The Master of Urban and Regional Planning degree program is recognized by the American Planners Association. The School is a member of the National Association of Schools of Public Affairs and Administration.

Fellowships

The School of Government and Business Administration has several graduate fellowships available to its students, including the Aryamehr Research Fellowships in International Business, Health Services Administration Fellowships, Ernst and Ernst Grant to Doctoral Candidates in Business or Economics, the National Association of Purchasing Management Fellowship, the Scottish Rite Foundation Fellowships, and the Wolcott Foundation Scholarships.

REGULATIONS

Regulations concerning admission, registration, fees and finances are stated on pages 19-32; other University regulations, on pages 44-52.

Attendance

A student may not attend classes until registration is completed and fees

due are paid. A student may be dropped from any course for undue absence.

The student is held responsible for all the work of the courses in which registered, and all absences must be excused by the instructor in charge before provision is made for the student to make up the work missed.

A student suspended for any cause may not attend classes during the period of suspension.

Withdrawal

Withdrawal from a course or from the University without academic penalty is permitted during the first five weeks after registration for the fall or spring semester. Withdrawal after this period is permitted only in unusual circumstances, and requires certification by the instructors of courses for which the student is registered that the student is doing passing work (see "Withdrawal," page 47).

Adding Courses

Courses may not be added after the first two weeks of classes in any semester.

Independent Study Plan

A student of *demonstrated capacity*, with a special interest in the subject matter of a course, may be permitted to undertake study under the personal direction of an instructor, in accordance with the rules of the appropriate department. Credit under this plan is limited to the specific course credits normally allowed when taken on a class basis.

Use of Correct English

Any student whose written or spoken English in any course is unsatisfactory may be reported by the instructor to the dean. The dean may assign supplementary work, without academic credit, varying in amount with the needs of the student. If the work prescribed is equivalent to a course, the regular tuition fee is charged. The granting of a degree may be delayed for failure to make up such deficiency in English to the satisfaction of the dean.

Students From Other Schools Within the University

Degree candidates from other schools of the University cannot register for more than 12 hours of credit in courses from the Bachelor of Business Administration or Master of Business Administration degree programs.

Common Body of Knowledge

Programs leading to the degrees of Bachelor of Business Administration and Master of Business Administration include the equivalent of at least one year of work in the following areas:

1. a background of the concepts, processes, and institutions in the production and marketing of goods and/or services and the financing of the business enterprise or other forms of organization;
2. a background of the economic and legal environment as it pertains to profit and/or nonprofit organizations, along with ethical considerations and social and political influences as they affect such organizations;
3. a basic understanding of the concepts and applications of accounting, quantitative methods, and information systems;
4. a study of organization theory, behavior, and interpersonal communications;
5. a study of administrative processes under conditions of uncertainty, including integrating analysis and policy determination at the overall management level.

THE BACHELOR OF BUSINESS ADMINISTRATION DEGREE

The School offers programs leading to the degree of Bachelor of Business Administration in the fields of accounting; business, economics, and public policy; finance; information systems technology; marketing; and personnel management.

ENTRANCE REQUIREMENTS

Good character and an academic background appropriate for the program of studies contemplated are required.

Requirements for admission to the freshman class include:

1. An acceptable certificate of graduation from a U.S. secondary school, showing at least 15 units* which must include four years of English; at least two years of one foreign language; two years of science, preferably with laboratory instruction; two years of social studies, one of which must be American history; and one year of college-preparatory mathematics beyond introductory algebra. An applicant whose high school record is deficient in any of these units cannot be admitted until such deficiencies are made up.

International students may be considered for admission with an equivalent foreign secondary certificate. A student presenting a U.S. secondary certificate or its foreign equivalent must also show competence in the English language by scoring not less than 550 on the first taking of the TOEFL or 600 on the second taking. International students may be required to enroll in a full-time program in English before beginning studies in a degree program.

2. College Entrance Examination Board scores submitted on the Scholastic Aptitude Test. (Normally, students with SAT verbal scores below 450 or SAT math scores below 500 will not be admitted.)

Criteria for admission include a strong high school record and a satisfactory performance on the Scholastic Aptitude Test examinations. It is recommended that the examinations be taken in December or January. Scores on tests taken in the junior year may be submitted. Arrangements for tests are the responsibility of the applicant and should be made with the Educational Testing Service, 20 Nassau St., Princeton, N.J.

* A unit represents a year's study in a secondary school subject, including in the aggregate not less than 120 sixty-minute periods, or the equivalent, of prepared classroom work.

08540, or 1947 Center St., Berkeley, Calif. 94704, not less than one month before the date of the test. In applying for the test, the applicant should specify that the scores be sent to the Office of Admissions, George Washington University, Washington, D.C. 20052.

The College Entrance Examination Board tests are preferred; however, the American College Testing battery scores will be accepted. The applicant should request that these scores be sent to the Office of Admissions directly from the American College Testing Program, Iowa City, Iowa. It is recommended that the applicant take the tests in October of the senior year.

Admission with Advanced Standing

Requirements for admission of students transferring from other regionally accredited colleges and universities and from other divisions of this University, are as follows:

Ordinarily, students who have accumulated (1) no more than 30 semester hours of transferable relevant academic credit must have a minimum 2.00 cumulative grade index, as well as meeting the freshman requirements; or (2) 31-60 transferable semester hours of relevant academic credit must have a 2.50 cumulative grade index or higher; students with less than 2.50 but not less than 2.00 must meet the freshman requirements or (3) 61-90 transferable semester hours of relevant academic credit must have a 2.50 or higher cumulative grade index. Advanced standing may be awarded for properly certified courses taken at regionally accredited colleges or universities for which the student received a grade of *C* or better and may be applied toward a degree provided they are comparable to the curricular requirements of the degree.

In no case will more than 60 semester hours of advanced standing be granted for course work completed at regionally accredited community or junior colleges. Upper-level courses taken at such colleges may be applied toward the Bachelor of Business Administration degree provided they are comparable to BAd 161, Mgt 118, or Mgt 119. Other courses (one course per area up to a maximum of three courses), comparable to the School's courses numbered 101-200, taken at an accredited community or junior college with an earned grade of *C* or better, may be accepted to waive certain required courses. The waiver of a required course does not entitle the student to any semester hours of credit.

Although a grade of *D* is not acceptable for transfer of credit, the course may be used to waive a curricular requirement. Credits earned with a *D* grade may not, however, be counted toward the total number of semester hours required for the degree. Any course completed with a grade of *D* or better may not be repeated for the purpose of earning degree credit.*

The School reserves the right to refuse credit for transfer in whole or in part or to allow credit provisionally.

It is the responsibility of the student to have an official transcript sent directly from each institution formerly attended to the Office of Admissions, Rice Hall, George Washington University, Washington, D.C. 2005

* An exception to this rule is the freshman English composition requirement. Any student earning a grade lower than *C* in English composition at another institution may be required to repeat the course(s) at this University.

A student wishing to transfer into the School from another division of this University must submit a formal application of transfer to the Office of Admissions in Rice Hall.

Courses taken at another division of this University may be applied toward a degree in this School provided they are comparable to the curricular requirements of the degree. A maximum of 90 semester hours of transfer credit may be applied toward a degree program in this School.

In no case will credit for more than 15 semester hours of undergraduate course work taken at this University in nondegree status be allowed toward meeting degree requirements in the School of Government and Business Administration.

Readmission

A student who withdraws, is suspended or is otherwise absent from the University for one semester or more must make formal application for readmission. If readmitted, the student is subject to the rules and regulations in force at the time of return. If the student has attended one or more regionally accredited colleges or universities during absence from the University, complete official transcripts must be sent to the Office of Admissions from each institution attended.

The application fee is waived for a student applying for readmission who was registered as a degree candidate at the time of last registration at the University and who has not since registered at another college or university.

REQUIREMENTS FOR THE DEGREE

Academic Work Load

A full-time student not on probation may not ordinarily take more than 15 semester hours. A student employed more than 24 hours a week, who is not on probation, may not take more than nine semester hours.

A full-time student whose overall quality-point index is 3.50 or higher may take up to 18 semester hours. A student employed more than 24 hours a week, whose index is 3.50 or higher, may take up to 12 semester hours.

A student who accepts employment after registration or at any time during a semester must report immediately to the Dean, so that the program may be adjusted if necessary.

Exception to these rules will require the approval of the Dean.

An undergraduate student on probation may take no more than 12 semester hours of course work.

Scholarship Requirements

A student must have the following to graduate: (1) an overall quality-point index of at least 2.00 and (2) a quality-point index in the major of at least 2.00. All courses which are acceptable for credit toward the Bachelor of Business Administration degree are to be included in the *overall quality-point index* calculation. Elective courses in or out of the School of Government and Business Administration cannot be used as substitutes for required courses in the calculation of the *major quality-point index*. Only 100-level courses are used in the *major quality-point index* calculation.

DEAN'S HONOR LIST

The names of students who achieve a quality-point index of 3.50 or higher are placed on the Dean's Honor List for that semester. Appearance on the list will be limited to (1) full-time students registered for a minimum of 12 semester hours (provided that the 12 hours are taken for a grade) and (2) part-time students registered for a minimum of 12 semester hours over a period of two consecutive semesters, which may include a summer term.

INCOMPLETE/AUTHORIZED WITHDRAWAL

Conditions under which the grades of *I* (Incomplete) or *W* (Authorized Withdrawal) may be assigned are described on page 45.

The grade of *I* must be removed no later than the last day of the examination period for the fall or spring semester immediately following the semester or summer session in which the grade of *I* is assigned. An "Incomplete" that is not removed within this period is automatically changed to an *F*. In cases of well-documented extenuating circumstances, an instructor and a student may jointly petition the dean for additional time in which to complete the work of the course. Such petitions should be submitted within the same period. The grade of *I* cannot be removed by reregistering for the course here, or by taking its equivalent elsewhere.

PROBATION

A student whose quality-point index (either overall or in the major) falls below 2.00 after completing a minimum of 12 semester hours of study will be placed on probation. This probation extends over the period in which the student attempts another 12 semester hours of work, which may include remedial studies as prescribed.

SUSPENSION

A student whose quality-point index (either overall or in the major) is 1.50 or below, or whose index remains below 2.00 at the end of the probationary period, will be suspended. A student suspended for poor scholarship may apply for readmission after the lapse of either a fall or spring semester. To be considered for readmission, the student must pass prescribed tests and submit evidence of conduct during absence from the University which indicates that the student will profit from readmission. A student readmitted after suspension is on probation and must maintain a current quality-point index of at least 2.50 on each 12 semester hours of work undertaken until the cumulative (or major) index is 2.00. In no case will the probationary period after readmission exceed 24 hours of study. A student suspended twice for poor scholarship will not be readmitted.

PASS/NO PASS OPTION

A junior or senior student who has a cumulative quality-point index of 2.50 or better, may, with the approval of the advisor and the dean, take one course a semester and receive a grade of *P*, Pass, or *NP*, No Pass, which will be recorded on the student's transcript but will not be reflected in the quality-point index. No student will be allowed to take more than four pass/no pass courses. A student must sign up for such an option at registration. Under no circumstances may a student change from pass/no pass status to graded status, or vice versa, after the end of

registration. Required courses may not be taken on the pass/no pass basis. A transfer student may not choose this option until the second semester of enrollment in the University.

Residence

A minimum of 30 semester hours, including at least 12 hours in the major field, must be completed while registered in the School of Government and Business Administration. This requirement applies to students transferring within the University, as well as to students transferring from other institutions. Unless special permission is granted by the dean to pursue work elsewhere, the work of the senior or final year must be completed in the School of Government and Business Administration.

Correspondence and Home-Study Courses

Credit for correspondence or home-study courses is not acceptable and cannot be applied toward a degree in the School of Government and Business Administration.

Earning Credit or Waiving Requirements by Examination

A student may earn credit up to a maximum of 30 semester hours or waive curricular requirements by performing satisfactorily on the following tests:

College-Level Examination Program (CLEP)—See page 22 for general information on the CLEP tests. CLEP tests in Introductory Accounting, Introduction to Business, Commercial Law, and Data Processing are limited to three credits each of advanced standing. CLEP tests in college algebra/trigonometry, English composition, and more advanced courses in accounting and business administration are not accepted for advanced standing. Students enrolled in George Washington University who wish to receive credit for CLEP Subject Examinations must receive prior approval of the department.

Advanced Placement Tests—See pages 21-22.

Achievement Tests—See page 23.

Examinations for Waiving Curriculum Requirements—The School of Government and Business Administration does not administer waiver examinations. However, certain arts and sciences courses may be waived, and in some instances credit may be assigned, by satisfactorily passing a special departmental examination authorized and prescribed by the department or curricular advisor concerned. Requests to take the examination should be made to the curricular advisor and the required fee paid at the Office of the Cashier before the date set for the examination. See page 75 for more information.

CURRICULUM REQUIREMENTS

One hundred and twenty semester hours of course work are required for graduation. To be recommended by the Faculty for graduation, candidates are required to complete, in addition to the appropriate freshman and sophomore work, a minimum of 60 semester hours (second-group course work) in the junior and senior years selected from one of the six major

fields of instruction offered by the School. Courses must be taken in accordance with the academic status of the student (i.e., freshman, sophomore, junior, senior) and the course prerequisites. The major field of instruction must be selected at the end of the sophomore year.

Math 3, 6, and 9 may not be used for credit towards the B.B.A. degree. First-year foreign language courses may be used as freshman electives provided that the student has not previously studied the language at the secondary level.

Curriculum for the First Two Years for All Bachelor of Business Administration Students

FRESHMAN YEAR		Semester Hours
Mathematics:	Math 31–32 or 51–52	6
Economics:	Econ 1–2	6
English:	Engl 9 or 10, 11*	6
Science:	BiSc 3–4; Chem 3–4; Geog 1, 2; Geol 1–2; or Phys 9–10	6
Elective:	Courses other than accounting, business administration or economics†	6
	Total	30

SOPHOMORE YEAR		
Accounting:	Acct 51–52	6
Business Administration:	BAd 51	3
Humanities:	Art 31–32 or 71–72; Chin 3–4; Engl 51–52, 71–72, or 191–92; Fren 3–4 or 6, or 51–52; Germ 3–4 or 51–52; Ital 3–4; Mus 3, 4; Phil 45, 50, or 71; Rel 9–10, 21, 22, 23, 59, 60; Slav 3–4, 5–6, or 91–92; Span 3–4 or 6, or 51–52; or SpDr 1, 11	6
Social Sciences:	Psyc 1, 8	6
	AmCv 71–72; Anth 1–2; Hist 39–40 or 71–72; PSc 1, 2; or Soc 1, 2	9
Statistics:	Stat 51	3
	Total	30

Major in Accounting‡

The principal objective of the undergraduate program in accounting is preparation for a professional career in accounting. Although professional preparation requires specialization in the acquisition of accounting knowledge in the junior and senior years, attainment of the objectives requires a general education in English, humanities, social sciences, mathematics,

* Engl 50 (English Composition/Research Methods for International Students) may be substituted for Engl 9 or 10, provided that a grade of C or better is received, and that the student is ready to go on to Engl 11. A student who has received credit for Engl 50 may not receive credit for Engl 9 or 10.

† Restricted to lower than 100-level courses. (Courses in human kinetics and leisure studies may not be taken for credit.)

‡ To be accepted in the undergraduate accounting program a cumulative grade average of 2.50 or higher is required at the start of the junior year.

and sciences in the first two years of undergraduate study. In addition, a common body of knowledge in business administration is necessary during the junior and senior years, with special reference to the needs of the student in the accounting program. An additional objective is the preparation of students for a fifth-year or Master of Accounting program. This is intended to meet the academic needs of students seeking professional accounting careers in the public or private sector which currently demand high entry-level academic achievement.

JUNIOR YEAR

		Semester Hours
Acct 101:	Cost and Budgetary Control	3
Acct 121:	Intermediate Accounting	3
Acct 161:	Federal Income Taxation: Individuals	3
Acct 191:	Advanced Accounting	3
BAd 102:	Fundamentals of Management	3
BAd 131:	Business Finance	3
BAd 141:	Basic Marketing Management	3
BAd 161:	Commercial Law	3
Mgt 116:	Introduction to Information Processing	3
Engl 100:	Expository Writing in Accounting	3
	Total	30

SENIOR YEAR

Acct 132:	Accounting Theory	3
Acct 171:	Auditing	3
Acct 181:	Accounting Systems	3
BAd 101:	The Business Environment	3
BAd 198:	Business Policy and Administration	3
Mgt 119:	Computer Programming for Information Systems	3
Econ 121:	Money and Banking	3
Stat 103:	Sampling in Accounting	3
Elective:	Three semester hours selected from courses in accounting,* business administration, or economics, and three semester hours selected from courses in other departments	6
	Total	30

ACCOUNTING PRACTICE INTERNSHIP

An internship program, limited to selected senior accounting majors, is available during the semester break of the senior year. To be admitted to this program students must have the approval of the chairman of the Department of Accounting and must have completed at least 15 semester hours of accounting courses, including a course in auditing, by the end of the fall semester of the senior year, with a grade average of 3.0 both in accounting and overall at the start of the fall semester of the senior year. Students will be paid a salary while conducting audits under senior supervision of participating C.P.A. firms. Other internships with industry and government are available. Students who complete the

* Qualified students accepted in the accounting internship program will elect Acct 199 in place of three semester hours of electives selected from courses in accounting, business administration, or economics.

internship successfully will register for Acct 199 the spring semester of their senior year and will receive three semester hours of credit. For further information consult the chairman of the Department of Accounting.

Majors in Business, Economics, and Public Policy; Finance; Information Processing; Marketing; and Personnel Management

The programs in these five fields of instruction are designed to provide the broad foundation required for eventual leadership in either business or governmental administration. The programs consist of 36 semester hours of required general business administration courses; 15 hours of required major-related courses; and nine hours of electives, normally advanced courses in liberal arts subjects.

JUNIOR YEAR

		Semester Hours
Acct 193:	Business Budgeting	3
BAd 102:	Fundamentals of Management	3
BAd 105:	Personnel Management	3
BAd 131:	Business Finance	3
BAd 141:	Basic Marketing Management	3
Mgt 118:	Introduction to Information Processing	
Major-Related Courses:	Six semester hours selected from the chosen area of specialization (see below)	6
Elective:	To be selected in consultation with the advisor	3
	Total	30

SENIOR YEAR

BAd 101:	The Business Environment	3
BAd 161:	Commercial Law	3
BAd 181:	Manufacturing Production	3
BAd 198:	Business Policy and Administration	3
Econ 121:	Money and Banking	
*Psyc 144:	Personnel and Industrial Psychology or	3
Mgt 107:	Fundamentals of Behavioral Science	
Major-Related Courses:	Nine semester hours selected from the chosen area of specialization	9
Elective:	To be selected in consultation with the advisor	3
	Total	30

The major field should be selected at the end of the sophomore year. The student should contact the Assistant Dean for Undergraduate Programs for the assignment of a faculty advisor. Major-related courses for business, economics, and public policy; finance; information processing; marketing; and personnel management are described below.

1. Business, Economics, and Public Policy

This field is directed toward developing understanding and skills applicable to a wide variety of positions in business and government. Students will supplement basic course work in business and economics with additional courses in

* Marketing majors should complete BAd 146, Consumer Behavior, in lieu of this requirement.

economics, political science, and government-business relations. The social, legal, political, and economic environment of business and the micro- and macroeconomic foundations of governmental programs and regulatory activity will be studied to establish a basis for developing and evaluating effective business responses. The program is concerned with the continuing business-government dialogue on effective and equitable relations between the two sectors of the economy.

The following courses provide a basic academic foundation in the area of business, economics, and public policy:

BAd 107: Collective Bargaining
BAd 132: International Business Finance
BAd 176: International Business Theory and Policy
*Econ 101: Intermediate Microeconomic Theory
*Econ 102: Intermediate Macroeconomic Theory
Econ 136: Natural Resources and Environmental Economics
Econ 158: Industrial Organization
Econ 159: Government Regulation of the Economy
Econ 161: Public Finance I
Econ 162: Public Finance II
Econ 181–82: International Economics
PSc 116: The American Presidency
PSc 117: Public Administration and Bureaucratic Politics
PSc 118: Legislative Process

2. Finance

This field helps students develop the skills required for entry-level employment in corporations, financial institutions, and the public sector. Corporations employ entry-level finance specialists for cash, credit, or inventory analysis or management and for work in bank relations and capital budgeting. Financial institutions offer opportunities for entry-level finance specialists to analyze specific securities and to assist in loan analysis. The government sector looks to finance majors as potential financial analysts. The undergraduate B.B.A. degree with a finance major also provides an excellent foundation for graduate academic programs, especially the study of law.

The following courses provide a basic academic foundation in the field of finance:

Acct 111: Financial Statement Analysis *or*
Acct 121: Intermediate Accounting
BAd 113: Real Estate Investment *or*
BAd 121: Fundamentals of Insurance and Risk Management
BAd 132: International Business Finance
BAd 133: Capital Formation
BAd 134: Working Capital Management
*BAd 138: Investment and Portfolio Management
*BAd 139: Advanced Financial Management

3. Information Processing

Students taking this field are recruited by organizations in both the public and private sectors for positions as programmer/analysts and systems designers. These entry-level positions lead to careers in the marketing of computer hardware and software, systems consulting, and management. Medium to large organizations are currently expanding their reliance on computer systems and, with the development of inexpensive but powerful mini- and microcomputers, thousands of smaller organizations are finding computers to be cost-effective as well.

* Required for this major field.

Students will supplement the basic skills learned in the B.B.A. curriculum with courses planned to provide a firm foundation in the use of the computer as a tool in solving information problems in organizations. These courses relate ongoing, real-world applications of computers to the functional areas of business and government organizations.

The following courses provide a basic academic foundation in the area of information processing:

†CSci 157:	Machine and Assembly Language Programming
†CSci 158:	Algorithmic Methods and High-Level Languages
*Mgt 119:	Computer Programming for Information Systems
*Mgt 120:	Information Systems Development I
*Mgt 121:	Information Systems Development II
*Mgt 122:	Special Studies in Information Systems
Phil 121:	Symbolic Logic
Stat 114:	Data Structures

4. Marketing

This field has the objectives of: (1) developing a conceptual understanding of a complex and changing environment and its effects on marketing activities and institutions; (2) understanding the dynamics of buyer behavior; (3) providing the skills to analyze demand, market segments, and cost-volume profit relationships of marketing programs; (4) enhancing abilities in written and verbal communications; and (5) developing skills in formulating and implementing comprehensive marketing plans.

Typical entry-level positions for students with marketing majors are: advertising account executives, marketing research project managers, retail assistant buyers, and sales representatives for consumer or industrial products firms. Students with marketing backgrounds also have obtained positions in physical distribution, public relations, wholesale firms, and a variety of governmental and non-profit organizations.

The following courses provide a basic academic foundation in the area of marketing:

*BAd 143:	Marketing Research
BAd 144:	International Marketing Management
*BAd 145:	Sales Management
BAd 147:	Advertising
BAd 148:	Seminar: Retailing Management
*BAd 149:	Marketing: Strategic Planning
BAd 171:	Transportation and Logistics Management
BAd 175:	Introduction to International Business
Jour 145:	Principles and Problems of Public Relations
Stat 105:	Statistics in the Behavioral Sciences
Mgt 119:	Computer Programming for Information Systems

5. Personnel Management

This field is concerned with all aspects of the employment of human resources in business organizations. Entry-level career opportunities are in such fields as personnel management, employee relations, collective bargaining, and manpower utilization. Since the field focuses on the management of human resources in a general sense, this concentration also prepares the student for responsibilities associated with general management and leadership.

The following courses provide a basic academic foundation in the area of personnel management:

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* Required for this major field.
† See the School of Engineering and Applied Science Bulletin.

*BAd 106:	Leadership in Personnel Management
*BAd 107:	Collective Bargaining
Jour 145:	Principles and Problems of Public Relations
Psyc 129:	Theories of Personality
Psyc 131:	Psychological Tests
SpDr 121:	Group Discussion and Conference Leadership

THE MASTER'S DEGREES

ENTRANCE REQUIREMENTS

To be considered for admission, applicants must present a Bachelor's degree from a regionally accredited college or university. Application is made directly through the Admissions Office, School of Government and Business Administration. Admission to Master's programs is granted on a highly competitive basis. Previous academic history, performance on the applicable entrance examination, letters of reference, motivation and aptitude to do graduate-level work, and professional experience are all taken into consideration.

Applicants for admission to programs leading to the degrees of Master of Accounting and Master of Business Administration must submit acceptable scores on the Graduate Management Admission Test; applicants for admission to programs leading to the degrees of Master of Health Services Administration and Master of Urban and Regional Planning must submit scores on the Graduate Management Admission Test, the Miller Analogies Test, or the Graduate Record Examination; applicants for admission to programs leading to the degrees of Master of Public Administration and Master of Science in Information Systems Technology must submit scores on the Graduate Record Examination. It is the responsibility of the applicant to make arrangements for the required test with the Educational Testing Service, Princeton, N.J. 08540. Correspondence concerning the Graduate Management Admission Test should be addressed to Box 966; concerning the Graduate Record Examination, to Box 955.

GENERAL REQUIREMENTS

All students must complete the prescribed minimum number of semester hours of graduate course work. A maximum of one-quarter of the semester hours of graduate course work required for a degree may be approved for transfer to the School of Government and Business Administration from the Division of University and Summer Students, another degree-granting division of this University, or another regionally accredited college or university under the following conditions: the course work must be approved as part of the student's program of studies, it must not have been applied to the completion of requirements for another degree, it must be at the graduate level, it must have been taken within the past two years, and the student must have received a grade of *B* or better. This action must be approved by a petition to the advisor and the dean. A transcript of the course work must be on file before the petition can be considered. Should advanced standing be granted, the credit will count; however, the grade will not be used in calculating the cumulative grade point average.

* Required for this major field.

Extended programs, including undergraduate background courses, may be assigned for an applicant whose undergraduate degree was in a field other than the graduate program the student wishes to follow, or whose undergraduate record indicates a weakness in required background courses.

Master's degrees are awarded by vote of the Faculty on completion of the required course work, an acceptable thesis (if one is elected or required) or the equivalent work, and the passing of the Master's Comprehensive Examination if required in the chosen degree or concentration.

Second-group courses (numbered 101-200) may be counted toward the master's degree only when registration for graduate credit has been approved at the time of registration by the dean and the curriculum advisor. No work counted toward a bachelor's degree may be counted toward a master's degree.

Full-time students are normally expected to register for nine to 12 semester hours each semester. A graduate student who is employed more than 20 hours a week may not take more than six semester hours. All work for a master's degree must be completed in five years, unless an extension of time is granted by the dean.

Students who expect to continue studies for the degree of Doctor of Business Administration or Doctor of Public Administration after receiving the master's degree should ask for assistance in planning programs so that they may qualify for admission to candidacy for the doctorate.

No credit is granted for work done *in absentia* or without formal instruction, except for hospital residency, supervised field experience and the thesis, which may be completed *in absentia* with the permission of the department, curriculum advisor or committee concerned.

MASTER'S COMPREHENSIVE EXAMINATION

Written Master's Comprehensive Examinations are required only in certain degrees and fields of instruction. Degree candidates should consult faculty advisors about examinations required and material to be covered. In writing the examinations students are expected to correlate what has been learned in course work and from the literature of the field. The examinations normally require four to eight hours. Sections broadly cover the various fields which the candidate has selected.

Examinations are generally scheduled in the fall and spring semesters and should be taken during the last semester of course registration or shortly after completion of prescribed course work.

A written application is filed with the department supervising the student's field of study at the time of registration for the semester in which the examination is to be taken. Before applying, the student must have completed all courses in the program or be enrolled in the last semester and must have achieved a 3.00 (*B*) average. After applying for the examination, a candidate may withdraw only by written notice to the department chairman.

A candidate who fails the examination should consult with the faculty advisor as to a subsequent course of action.

SCHOLARSHIP REQUIREMENTS

Grades for graduate work are *A*, Excellent; *B*, Good; *C*, Minimum Pass;

F, Fail; *I*, Incomplete; *IP*, Progress; *CR*, Credit; *W*, Authorized Withdrawal; and *Z*, Failure, Unauthorized Withdrawal.

An average of *B* or better is required for the master's degree. The grade of *C* is not considered as failing but must be balanced by a grade of *A* in a graduate course of equal status. A minimum grade-point average of 3.00 is required for award of a graduate degree. All courses taken after matriculation as a graduate student (except for *Audit* or *CR*) will be used in the calculation of the grade-point average.

A student whose quality-point index falls below 3.00 will be placed on probation. This probation extends through the period in which the student next attempts 12 semester hours of work, including prescribed courses. During this period the student's performance will be monitored to determine suitability for continued study. A student who is subject to probation for a second time is automatically suspended.

A master's degree candidate who receives a grade of *F* is required to present cause, for consideration by the dean, as to why continued study should be permitted.

A master's degree candidate given the grade of *F* in a required course, and permitted to continue in graduate studies, must repeat the course and achieve at least the grade of *B*. (Such a retake does not expunge the grade of *F* and it remains part of the student's record.) Should this level of performance not be obtained, the student will be denied further registration as a degree candidate.

SUSPENSION

A graduate student who does not meet the conditions of probation (see above) will be suspended or asked to withdraw. A student who is suspended or withdraws under these conditions may apply for readmission after the lapse of one semester. To be readmitted the student must submit evidence which indicates academic success if readmitted. A student so readmitted will continue on academic probation and must achieve a minimum quality-point index of 3.50 in the next 12 semester hours of graduate study. Should the student fail to achieve this minimum quality-point index a second suspension will result and subsequent readmission will be denied.

INCOMPLETE/AUTHORIZED WITHDRAWAL

Conditions under which the grades of *I* (Incomplete) or *W* (Authorized Withdrawal) may be assigned are described on page 45.

The grade of *I* must be removed no later than the last day of the examination period for the fall or spring semester immediately following the semester or summer session in which the grade of *I* is assigned. An "Incomplete" that is not removed within this period is automatically changed to an *F*. In cases of well-documented extenuating circumstances, an instructor and a student may jointly petition the Dean for additional time in which to complete the work of the course. Such petitions should be submitted within the same period. The grade of *I* cannot be removed by reregistering for the course here, or by taking its equivalent elsewhere.

The Thesis

Students contemplating doctoral study are strongly urged to include the thesis as an elective in their master's program. The thesis subject should be

selected as early as possible so as to permit effective integration with the course work.

The subject must be approved by the professor in charge of the student's field. The thesis in its final form must have the approval of the professor in charge and must be presented to the Dean by the student no later than the date announced in the calendar. Printed copies of detailed regulations regarding the form and reproduction of the thesis are available in the Office of the Dean.

Payment of tuition for the thesis entitles the candidate, during the two semesters in which registered for thesis (299–300), to the advice and direction of the member of the Faculty under whom the thesis is to be written. In case a thesis is unfinished, additional time is granted. The student must, however, be enrolled continuously in the program. If the preparation of the thesis extends more than three semesters beyond the date registered for thesis 300, the student must register for the entire six hours of thesis again and pay tuition as for a repeated course.

MASTER OF ACCOUNTING

The Master of Accounting degree is designed to prepare students for professional careers in accounting. Although accounting careers may be in the public or private sector, a particular objective of the program is the student's attainment of professional certification. The Master of Accounting is recognized as the necessary fifth year of education in a professional accounting program, and as such, it is superimposed on a Common Body of Knowledge in accounting and business subjects. The Common Body of Knowledge is ordinarily attained by the completion of a bachelor's degree in accounting or business from an accredited institution of higher education. A minimum of 30 semester hours of graduate course work will be required of all students who have completed the prerequisite courses prior to admission to the program (see page 200). Specific prerequisite courses required in accounting and business will vary, based on the student's status upon admission to the program. Successful completion of a comprehensive examination in the final semester of course work is required.

MASTER OF BUSINESS ADMINISTRATION

The Master of Business Administration degree is recognized as the best preparation for careers in management. The program of study leading to the Master of Business Administration provides a basic foundation in the functions of business, the environment in which it operates, and the analytical tools needed for intelligent decision-making. The program provides a study in depth in one field of instruction and a broad exposure to subjects and issues at the general management level.

The program consists of 60 semester hours of course work, of which 27 may be waived if comparable study has been completed prior to admission. Thus, the minimal program is at least 33 semester hours.

The program of study consists of two levels:

First Level:

Common Body of Knowledge Courses (30 hours)

Econ 217–18; Acct 201; Mgt 200, 218, 270; BAd 201, 230, 240, 297

This set of courses must be completed prior to enrollment in Second-Level courses, except for BAd 297 which must be taken in the last semester of the program. All of these course requirements, except BAd 297, may be satisfied by evidence of successful completion of comparable work at other institutions. Common Body of Knowledge courses not completed before the applicant matriculates in the School of Government and Business Administration will be assigned in the letter of admission. First-Level courses may not be taken to satisfy Second-Level requirements (breadth, field of instruction, or elective courses).

Second Level:

1. *Breadth Courses (15 hours)*

This set of courses provides exposure to a broad range of subjects intended to develop professional competence in general management. In consultation with the advisor, the student selects five courses from at least four areas outside the field of instruction. Thus the student has the flexibility to design a program that is tailored to individual career goals.

2. *Field of Instruction Courses (12 hours)*

The purpose of this set of courses is to give the student an understanding in a selected field. Courses are selected in consultation with the advisor and may be tailored to individual interests.

3. *Elective (3 hours)*

The student may select any graduate-level course to satisfy this requirement in consultation and with the approval of the advisor.

Fields of Instruction

Students select a minimum of 12 semester hours from one of the following fields.

BUSINESS, ECONOMICS, AND PUBLIC POLICY

This field is directed toward understanding, analyzing, and dealing with the principal forces shaping the total business environment. Special attention is paid to the policies and programs of governments, social and cultural change, and the structure, evolution, and fluctuations of the economy. Students concentrating in this area take courses that survey the social, legal, political, and economic environment of business and the micro- and macroeconomic foundations of government programs and of business response to these programs. Elective courses may be chosen in business representation, public decision-making, government regulation of business, government-business liaison functions, and public administration.

FINANCE AND INVESTMENTS

This field prepares students for careers in finance and investments, providing a background in business budgeting, controllership, treasury, long-range planning, reporting and financial management processes. Courses are designed to emphasize the planning, analysis, implementation, and controls necessary for making effective financial decisions. Instruction not only applies to manufacturing and trading enterprise but, in addition, includes railroad and public utility financing. Each, however, has distinctive operating features. Most financial dogmas have a universality that cuts across business lines, and variations are more a matter of degree than a form of substantive difference.

GENERAL MANAGEMENT SYSTEMS AND ORGANIZATIONAL CYBERNETICS

This field addresses the critical need for management to deal effectively with the fact that human institutions of all kinds tend to become larger and more complex as changes accelerate both socially and technologically. In many traditional academic fields general systems and cybernetic concepts have evolved as the interdisciplinary mode for understanding increasingly complex systems. This has profound relevance for the contemporary operating manager and policy-maker.

Because this program is essentially interdisciplinary and transcontextual in nature, the student is afforded an unusually broad range of opportunities to apply educational experience to managerial, organizational and societal problems. Professional and academic career potentials are available in the following fields: (1) research and teaching in the growing number of systems and cybernetics oriented programs now emerging in colleges and universities in the United States and elsewhere in the world; (2) institutional/environmental interface management or consulting; (3) system-focused organization development consulting or staff work; (4) corporate and government agency long-range (strategic) planning and control activities; and (5) advisory and staff positions and program directors in global agencies such as operating components of the United Nations, multinational corporations and foundations, and multi-governmental agencies such as OECD, as well as in the agencies and departments of national governments.

HUMAN SYSTEMS

This field of study reflects the assumption that the effective utilization of the behavioral sciences is concerned with both means and ends; that the specialist in behavioral science not only is skilled in theory and research but also applies technical and specialized knowledge as a conscious force in effective organizational growth and improvement. Thus, courses are designed to equip the student with organizational concepts and behavioral skills appropriate to optimizing the utilization of a human system's total resources.

This program helps to meet the need for professionals capable of designing, creating, and developing the necessary behavioral and organizational systems appropriate to rapidly changing societies. Emphasis is on the interrelationships of such dimensions as motivation, leadership, problem-solving, organizational growth, and increased complexity of modern organizations and their effect upon the functions of organizational development.

INFORMATION SYSTEMS MANAGEMENT

This field is designed to provide a managerial understanding of the principles of manual, mechanical, and electronic information processing, including computer programming concepts, methods, and languages; an appreciation of the capabilities, limitations, and selection procedure of information processing equipment; a knowledge of all phases of management information systems development, implementation, and evaluation; and an understanding of the roles of both management and systems personnel in information technology. It also provides an appreciation of the role of information systems as a tool of management.

Students participate in the development of management information systems; in the selection of computer equipment; and in the installation

management, and evaluation of management information systems—during class sessions.

INTERNATIONAL BUSINESS

This field is designed to prepare students for careers in firms operating on a multinational basis or about to enter the international field; for careers in the federal government and in international agencies concerned with business, industry and finance abroad; and for the commerce option of the Foreign Service Officer Examination.

This program is also designed to provide foreign students with the background and skills necessary to promote international business, and to prepare them for careers in foreign and domestic firms within their own countries and for commercial officer positions within their governments.

Each student's program is individually developed by the student's advisor according to the student's background and interests.

MANAGEMENT OF SCIENCE, TECHNOLOGY, AND INNOVATION

This field explores the many aspects of technology relating to and influencing research and development management, business, and public policy. The employment of "state-of-the-art" technology and the creation of new technology through research and development are important processes in the achievement of the objectives of both private firms and governments.

The research and development environment has many unique operational characteristics. The concentration has been designed to identify and study the problems associated with managing creative professional people in a dynamic technology. As a contextual area, the program stresses the need for students to undertake original and meaningful research involving political, economic, sociological, and operational problems encountered by management in industrial, governmental, and military research and development organizations.

MANAGEMENT PLANNING AND CONTROL

This field provides an integrated study in management systems for strategic planning and operational control to improve organizational effectiveness and efficiency in decision making.

MARKETING

This field is devoted to the development of professional marketing managers whose responsibilities may include planning and developing new products, services, and ideas; advertising, selling, and merchandising; and arranging distribution channel systems. Courses cover all aspects of the marketing management function. Foundation courses are *Marketing Management, Buyer Behavior,* and *Marketing Research.* Functional courses are *Promotion Management, Marketing Channels, Marketing Strategy,* and *Product/Service Management.* Specialized elective courses, *International Marketing, Industrial and Government Marketing,* and *Marketing and Public Policy,* utilize the resources of the Washington metropolitan area.

PERSONNEL MANAGEMENT

This field is concerned with all aspects of the employment of human resources in business organizations. Career opportunities are open in domestic and international business organizations, hospitals, trade as-

sociations, research and educational institutions and local, state and federal government agencies. Courses encompass all phases of the recruitment, selection, employment, and development of people, industrial relations, unionism, collective bargaining, labor relations and manpower utilization.

PROCUREMENT AND CONTRACTING

This field responds to a demand for greater professionalism imposed by the increasingly diverse goods and services created by our modern economy. As this diversity grows, organizations find the most efficient, and often the only, method of meeting needs is through procurement action. A sustained growth in purchase volume, variety, and complexity has occurred in both public and private sectors. This growth places ever greater demands upon the skill and resourcefulness of procurement and contracting personnel. The field has therefore been designed with the following objectives: (1) to provide a broad professional education in the knowledge and skills necessary for success in this field; (2) to help the student develop increased ability in analysis, decision-making, and communications; (3) to enhance the student's understanding of the economic, social, legal, and technological considerations present in procurement and contracting activity. This field of instruction is available in an elective field for Master of Public Administration students.

QUANTITATIVE ANALYSIS FOR DECISION-MAKING

This field develops a thorough understanding of quantitative or mathematical approaches to problems of managerial control and decision-making. While the program will develop a competent background in basic mathematical theory associated with the various techniques, it is oriented toward applications of the techniques rather than their theoretical mathematical content.

MASTER OF HEALTH SERVICES ADMINISTRATION

This 54-semester-hour program is designed to provide a core of generalist administrator courses for all students, coupled with specialized elective fields of instruction to meet the interests and career objectives of individual students.

The generalist core includes the following nine courses: HSA 202, 203, 207, 208, 209, 210, 212, 215, and Mgt 210. In addition, each student must take two advanced HSA courses, one chosen from Group I and one from Group II, from among the following:

Group I (Policy/Planning)—HSA 221, 223, 225, 227, 252, 255.

Group II (Management)—HSA 231, 233, 235, 236, 237, 238, 239.

During the last semester on campus, each student must also complete HSA 245 which serves to integrate the concepts and methods of health services administration.

The fields of instruction are each comprised of 18 credit hours, including an experience-based learning component. In some fields of instruction a one-year (9-semester-hour) administrative residency is mandatory. In other fields of instruction the student may choose a 3-semester-hour intern-

ship and 6 semester hours of additional course work as a substitute for the 9-hour residency. Consequently, fields of instruction fall into one of two patterns:

Residency Option—Specialist course work, 9 hours; administrative residency, 9 hours.*

Internship Option—Specialist course work, 15 hours; administrative internship, 3 hours.

Courses comprising the field of instruction may be taken in the Health Services Administration Department, the School of Government and Business Administration, the University, or the Consortium of Universities. Each student develops a set of conceptually related courses suitable for the field of instruction and the individual's career objectives. The choice of courses must be approved by the individual's faculty advisor and the department(s) offering courses.

This curriculum structure gives students an unusual opportunity to develop academic programs particularly suited to their needs. The core courses and the two advanced HSA courses provide students with generalist administrative competence; the nine fields of instruction offer a wide choice of areas in which to develop special expertise. In all but three fields of instruction, students have a choice concerning the amount of experiential learning they wish to include in their programs of study. This choice concerning the amount of field experience can affect the number of months required to complete the program; that is, for a full-time student the residency option will require 28 months, while the internship option will require 20 months.

Fields of Instruction

MANAGEMENT OF ACUTE CARE HOSPITALS†

This field of instruction is designed to provide an understanding of the organization, management, and interrelationships of hospital clinical, support, and administrative functions, and analysis of systems and procedures used to provide short-term inpatient services. Students are also provided with a managerial base in the areas of health services policy making, regulation, and legislation.

MANAGEMENT OF LONG-TERM SERVICES†

This field explores a wide range of medical and support services required on a recurring or continuous basis by individuals who are unable to function independently due to chronic mental or physical impairment. These services are provided in a variety of settings, including homes for the aged, chronic care, rehabilitation or psychiatric hospitals, hospitals or homes for the mentally retarded and developmentally disabled, geriatric centers, and the client's home. The field also provides a management base in the areas of health services planning, policy making, regulation, and legislation as applied to long-term care.

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* Students will not be permitted to enter any administrative residency unless they have attained a 3.0 grade-point average with no grades of I (incomplete).
† Nine-hour administrative residency is mandatory in this field of instruction.

MANAGEMENT OF AMBULATORY HEALTH SERVICES*

This field addresses the critical need for managing the delivery of health and medical services to individuals who do not require the constant supervision associated with inpatient care and who either can travel to the site where service is provided or can be treated in their domicile. Although this definition includes such activities as individual practice of medicine, instruction will focus only on the management of services in organizational settings in which two or more individuals are engaged in delivering ambulatory care as a service offered by a formal organization. Examples of settings for ambulatory services are hospital outpatient departments, medical group practices, health maintenance organizations (HMOs), and public health center clinics. Ambulatory services administrators also work in the areas of health services planning, policy making, regulation, and legislation.

HEALTH INFORMATION SYSTEMS

This field is designed to provide an understanding of information systems as they are used in the administration of health services. The application of electronic data processing or computers to health care is stressed. Although some knowledge of programming languages will be necessary, the concepts of information and computer systems will be emphasized. Examples of the areas of application are medical records, program evaluation, community/national health statistics, financial management assessment, and productivity control.

HEALTH SERVICES FINANCIAL MANAGEMENT

This field responds to a demand for a thorough understanding by the administrator of financial management in health institutions. The instruction includes managerial accounting, cost analysis, financial decision making, capital formation, and investment analysis, with specific adaptation to unique problems within the health care field.

HEALTH SERVICES MATERIALS MANAGEMENT

This field explores the management of physical resources in health service institutions. The instruction focuses on the purchasing and management of supplies and equipment, inventory management, contracting, cost allocation, plant operations, and facilities maintenance.

HEALTH SERVICES POLICY, MARKETING, AND PLANNING

This field is designed for those who wish to focus on strategic planning and marketing of health care systems and health care institutions and on health policy development and analysis. An emphasis on policy skills will enable the student to develop realistic and accurate statements of principles that can guide the health activities of governments, institutions, and other organizations. An emphasis on planning and marketing skills will enable the student to develop strategies based on values expressed by health services policies and to conduct marketing activities within health services organizations. Skills related to achieving acceptance of policies and implementation of plans will also be developed. The overriding concept is that of strategic health decision-making in an atmosphere of systematic inquiry with an awareness of values.

* Nine-hour administrative residency is mandatory in this field of instruction.

HEALTH SERVICES AND OPERATIONS RESEARCH

This field deals with the application of research techniques and methodologies to the delineation of policy issues and the generation of solutions to problems in the organization, delivery, and financing of health services. Operations research is the application of mathematical techniques such as linear and nonlinear programming, queuing models, and simulation to develop solutions for operating and policy problems.

HUMAN RESOURCES MANAGEMENT

This field covers resources planning, allocation, utilization, and development, and evaluation of health services personnel. Included are the various personnel functions, the development of personnel policies and procedures, employee and labor relations, and collective bargaining.

MASTER OF PUBLIC ADMINISTRATION

The Master of Public Administration (MPA) degree program prepares the student for a professional career in public service. The 42-hour program, outlined below, is intended to provide both a generic core for all students and specialized elective fields tailored to the interests and career objectives of each individual student. The curriculum provides graduate instruction in all areas recommended by the Guidelines and Standards for Professional Master's Degree Programs issued by the National Association of Schools of Public Affairs and Administration.

All students are required to complete an eight-course (24-semester-hour) core, which includes courses in public administration and management, public expenditure analysis, public policy, organization theory, human behavior in organizations, and research methods; at the end of the program, students are required to take PAd 289 which serves to integrate the diverse perspectives in public administration.

Each student selects, in addition, an elective field designed to provide him or her with deeper and broader knowledge in a field of particular interest. The elective fields generally require a four-course sequence. The program is sufficiently flexible that, with the approval of a faculty advisor, the student may design a special field when none of the fields offered matches individual learning and career objectives.

Students who lack substantial knowledge of the structure and functioning of government are strongly encouraged to take one of two courses in American administrative institutions: PAd 213 *Administration in the Federal Government* or PAd 242 *Administration of State and Local Governments*. The remainder of the program consists of two elective courses chosen by the student with the advisor's approval. The electives may be taken in any related program or discipline.

Because the public service requires a wide variety of expertise, students with all undergraduate degree backgrounds are considered for admission. There are no specific course prerequisites.

Required Courses

PUBLIC ADMINISTRATION REQUIRED CORE (24 hours)

1. PAd 205 Introduction to Public Administration and Management
2. PAd 295 Research Methods

3. PAd 296 Statistical Applications in Public Administration
4. PAd 261 Policy Analysis in Public Administration *or*
   PAd 260 Policy Formulation and Administration
5. Mgt 210 Individual and Group Dynamics in Organizations
6. PAd 221 Organization Theory and the Public Sector *or*
   PAd 223 Behavioral Factors in Large and Complex Organizations
7. PAd 252 Public Expenditure Analysis and Planning
8. PAd 289 Public Program Management and Policy Implementation

ELECTIVE FIELDS (12 hours) (See below)

AMERICAN ADMINISTRATIVE INSTITUTIONS (3 hours)

Either PAd 213, Administration in the Federal Government, or PAd 242, Administration of State and Local Governments, is recommended as an introductory course. Either course may be counted as 3 of the 12 hours required in the elective field.

ELECTIVE COURSES Two courses (6 hours)

Elective Fields*

The seven elective fields offered within the Department of Public Administration are described below. Other SGBA fields are described elsewhere. Twelve hours are required for each field.

BUDGET AND PUBLIC FINANCE

This field covers the processes and institutions involved in budgeting, including the practical requirements of financial management; addresses issues of intergovernmental finance in a Federal system; and imparts knowledge of alternative methods for allocating scarce public resources. The field is most directly suited to those who are or envision becoming budget analysts or financial management officers in public agencies.

GOVERNMENTAL ADMINISTRATION

This field offers the student a broad understanding of some of the major functions critical to effective public management, including personnel, budgeting, and the law. For those entering the MPA program directly from an undergraduate program, this field provides insight into several potential areas for future specialization, employment, or research. For mid-career public officials, this field provides the opportunity to explore more systematically and analytically the governmental functions they have observed in practice.

ORGANIZATION AND MANAGEMENT

This field gives primary attention to the processes by which organizations are structured and their work undertaken. It includes courses in organizational theory, but is also concerned with the management of governmental programs. It is for students who envision careers in administering public sector programs.

* Students may also elect such other standard four-course SGBA fields as: Business, Economic and Public Policy; Human Systems; Information Systems Technology; International Business and Quantitative Analysis for Decision-making. Students may also take an approved four-course sequence in the Department of Health Services Administration or the Department of Urban and Regional Planning. Moreover, a special field may be constructed, tailored to the student's academic interests and career objectives. To take a special field, the student writes a brief justification specifying the courses to be taken, and submits it by petition through the faculty advisor.

POLICY ANALYSIS AND EVALUATION

The policy field is designed for those who wish to focus on the processes of public decision-making, and to develop abilities to analyze and evaluate those processes. This field is most directly appropriate for those who now hold or anticipate taking staff analyst positions in government agencies, or similar positions in research or consulting firms.

PROCUREMENT AND CONTRACTING

This field covers the many activities of government performed under contractual arrangements. Increasingly, public agencies find the most efficient, and often the only, method of meeting needs is through procurement action. This dimension of public administration is often subject to unique practices and regulations, and requires the acquisition of specialized knowledge and skills in the processes of procurement and contracting. This elective field, offered jointly with the Department of Business Administration, promotes a better understanding of public-private interactions in procurement activities.

PUBLIC PERSONNEL ADMINISTRATION AND MANPOWER

This field addresses the traditional concerns in public administration with personnel, the staffing function of public organizations, and labor relations in the public sector. Courses are also offered in manpower development and the use of human resources. Graduates concentrating in this field typically work in personnel administration at some level of government.

URBAN ADMINISTRATION

This field is designed for students interested in pursuing careers in state and local government administration. Students learn to deal with a range of Federal, state, and local problems and issues, including alternative governmental structures and assignments of functions, sources of revenues and expenditure patterns, intergovernmental relations and management concerns, local government financing, and the formulation and analysis of urban policies.

Internships

Students with little or no professional experience are strongly encouraged to take an internship during the MPA program. There are many opportunities in the Washington area for intern experiences in Federal agencies, in county and city government agencies, and in the quasi-public sector. The Department assists students in securing appropriate internships; students are also encouraged to find internships on their own initiative. A substantial effort is made to relate the intern experience to the student's academic program. Internships may be paid or unpaid, and taken for credit or not for credit. To receive academic credit, students must have completed nine credit hours in the degree program. In general, internships for credit involve 15-20 hours of work per week for 14 weeks.

MASTER OF SCIENCE IN INFORMATION SYSTEMS TECHNOLOGY

The Master of Science in Information Systems Technology provides prep-

aration for a career in the application of computers to the data and information problems found in organizations today. The program emphasizes a practical understanding of contemporary design and implementation approaches utilized in the development of computer-based systems.

Degree Requirements

1. Twenty-one semester hours of prerequisite courses or equivalents as follows: Mgt 118, 119, 120, 121, 122; Math 31 and 32, or 51 and 52.
2. Completion of 30 semester hours of graduate course work with a QPI of 3.0, including the following courses plus 6 semester hours of electives: Mgt 241, 244, 245, 246, 247, 248, 250, 251.
3. Successful completion of a comprehensive examination.

MASTER OF URBAN AND REGIONAL PLANNING

The program of graduate study in Urban and Regional Planning leads to the professional planning degree of Master of Urban and Regional Planning. It is designed as preparation for careers on the municipal, county, state, and national levels, and for private practice. The course of study is designed to provide a broad education, to develop competence in planning theory and methodology, and to emphasize the analytical ability and creativity necessary for solving urban and regional problems. Each student's program is designed in consultation with an assigned faculty advisor in accordance with individual career plans.

The degree is awarded by vote of the Faculty after satisfactory completion of (1) from 45 to 50 semester hours of course work, depending upon the background and experience of each individual student, including a thesis equivalent to six semester hours (most students will ordinarily be required to take 50 semester hours); (2) a minimum of three months' full-time professional training in a planning agency under qualified supervision, with an acceptable written report to be submitted after completion of the training period; (3) a written Master's Comprehensive Examination; and (4) a thesis based on the candidate's research in the field of urban and regional planning.

POST-MASTER'S GRADUATE CERTIFICATE IN HEALTH SERVICES ADMINISTRATION

Students with a master's degree in an approved related field or with a master's degree and managerial experience may undertake studies leading to the Post-Master's Graduate Certificate in Health Services Administration. This program serves people who plan to begin a career in management, policy-making, or planning in the field of health services or who wish to supplement previous graduate study in health services administration.

Most students with adequate preparation in health services administration or a related management field should be able to complete the requirements by undertaking a 30-semester-hour program of study. Those lacking specialized preparation will need additional course work depending on career goals. Field experience assignments, if required, are in addition to the 30-semester-hour minimum.

Individual programs will be developed in consultation with a faculty advisor on the basis of the student's educational background, experience, and specific professional objectives.

All students must take at least one doctoral-level seminar in health services administration (HSA 310 or 330) and complete a 3-semester-hour research project (HSA 270). The remaining hours may be taken in health services administration or other appropriate disciplines.

DOCTORAL PROGRAMS

Study for the degree of Doctor of Business Administration (D.B.A.) and Doctor of Public Administration (D.P.A.) is supervised by the Committee on Doctoral Studies.

Admission

The minimum admission requirement is a bachelor's degree, preferably with a major appropriate to the proposed field of study. Applicants whose degrees are in fields other than business or public administration are expected to obtain the necessary background either before or soon after admission to the program. Scores on the Graduate Record Examination or the Graduate Management Admission Test are required. However, applicants who have taken the Law School Admission Test or the Medical College Admission Test may submit these test scores for consideration. Under special circumstances, scores on the Miller Analogies Test may also be submitted. Applicants whose test scores are more than 10 years old are encouraged, but not required, to take or retake the Graduate Record Examination or the Graduate Management Admission Test. Arrangements to take these tests must be made with the Educational Testing Service. Students whose native tongue is not English must also submit the Test of English as a Foreign Language (TOEFL) scores (see page 26).

The Doctoral Committee does not use specific cutoff points for grade averages and test scores. It carefully reviews each applicant's entire record and makes its selection on a competitive basis in keeping with enrollment limitations.

This evaluation takes three to four weeks, after which the Admissions Office notifies each applicant, through the mail, of the Committee's decision. Completed applications must be sent to the Admissions Office, School of Government and Business Administration, George Washington University, Washington, D.C. 20052, by March 1 for the fall semester and summer sessions, and by October 1 for the spring semester. Graduates of non-U.S. universities must apply by February 1 for the fall semester and summer sessions, and by September 1 for the spring semester.

Plan of Study

The doctoral programs in both Business Administration and Public Administration consist of two major parts: the pre-dissertation stage and the dissertation stage. The objective of the pre-dissertation stage is to provide the student with the theoretical foundations and practices of the major and supporting fields of study and with a command of the relevant quali-

tative or quantitative analytical methods. The objective of the dissertation stage is to have the student apply the obtained theoretical and practical knowledge and analytical methods to the resolution of a research problem. The research should be original and is expected to result in a contribution to the existing body of knowledge on business administration or public administration. Such a contribution can be either applied or theoretical. The total program must be finished in seven years; extensions beyond this time limit can be given by the Committee on Doctoral Studies only under very special circumstances.

The pre-dissertation stage is based on an individual study plan developed by the student under the guidance of a major and supporting field advisor during the first academic year. In the study plan the student must state long-range professional objectives, all proposed academic activities, methods of evaluation, and a semester-by-semester schedule.

All students, regardless of the degree they seek and of the major field of study, must include in their Study Plan Mgt 390, *Philosophical Foundations of Administrative Research*, and the multidepartmental course, 311-312, *Seminar: Public-Private Sector Institutions and Relationships*. These courses should be taken during the first academic year after admission.

In addition to the evaluation methods proposed in the study plan, the major and supporting field advisors are expected to evaluate the student's progress at the end of the first and second semesters after admission, and thereafter before the end of the spring semester of each academic year.

Major and supporting fields of study include:

Accounting
Business, Economics, and Public Policy
Finance and Investment
General Management Systems and **Organizational Cybernetics**
Health Services Administration
Human Systems
Information Systems Technology
International Business
Management of Science and Technology
Marketing
Materials and Operations Management
Personnel Management
Public Administration
Quantitative Analysis for **Decision-Making**
Urban and Regional Planning*

A student seeking a D.P.A. degree is required to take public administration at least as a supporting field, to include in the study plan three doctoral-level courses in public administration, and to engage in activities as specified by the field advisor.

A student admitted to the doctoral program with accounting as a major may be considered for a concurrent appointment as an adjunct instructor. Criteria for selection include a Master's degree and a C.P.A. See the department chairman for details.

While the major field of study must be selected from the above list, supporting fields can be chosen from other departments of the University. A student selecting a field outside of the School, however, must meet the academic and administrative requirements of the department involved.

For more detailed information on the program and its administration see the *Handbook of the Doctoral Programs in Business Administration and Public Administration*, available in the Doctoral Programs Office.

* Can be selected only as a supporting field.

SPECIAL PROGRAMS

Government Intern Scholarship Program

The Government Intern Scholarship Program offers annually 50 scholarships to assist government agencies in training carefully selected young men and women for administrative leadership in government career service. Each scholarship provides full tuition for two three-hour courses in one semester, and interns who maintain satisfactory standing in both their academic program and their government training program may qualify for a second scholarship for an additional semester.

Continuing Education in Health Services Administration

A nondegree program is conducted, both on campus and off campus, in the various areas of health services administration whenever a sufficiently large class is organized. Institutes, workshops, and lecture series are conducted under the auspices of program faculty and selected leaders from local, state, and regional areas on topics of current interest to the requesting organization. There is no specific prerequisite. Fees are to be announced.

International Institute for Health Services Administration

In recognition of special educational needs of students from other countries, the International Institute for Health Services Administration offers programs of instruction designed to meet these needs at either the degree or certificate level.

It is also equipped to enter into arrangements with principals of hospital systems in world-wide areas to assist in the preparation of teaching programs or the actual instruction of administrative personnel either abroad or at the University.

Combined Master's and Juris Doctor Degree Program

In certain instances arrangements may be made for students to work concurrently toward both the Juris Doctor degree in the National Law Center and a master's degree in some fields in the School of Government and Business Administration. Students must be admitted both to the National Law Center and, separately, to the School of Government and Business Administration and must meet all requirements in each degree program. It is possible for a student to complete work for both degree programs within four years.

Certification of Purchasing Managers

The School of Government and Business Administration participates in the three nationally recognized certification programs.

Certified Public Purchasing Officer (CPPO)
Administered by:
National Institute of Governmental Purchasing
1001 Connecticut Avenue, N.W.
Washington, D.C. 20036

Certified Professional Contracts Manager (CPCM)
Administered by:
National Contract Management Association
Crystal Plaza #1, Suite 808
2001 Jefferson Davis Highway
Arlington, Virginia 22202
Certified Purchasing Manager (CPM)
Administered by:
National Association of Purchasing Management
11 Park Place
New York, New York 10007

SCHOOL OF PUBLIC AND INTERNATIONAL AFFAIRS

Dean B.M. Sapin

FACULTY 1981-82*

Professors J. Aschheim, R.H. Davison, R.M. Dunn, Jr., R.S. Goldfarb, M. Gordon, A. Gyorgy, P.P. Hill, H.C. Hinton, M.A. Holman, C. Hsieh, J.W. Kendrick, Y. Kim, P.F. Klarén, H.L. LeBlanc, R.K. Lewis, W.H. Lewis *(Visiting)*, J.M. Logsdon, J.C. Lowe, J.A. Morgan, Jr., J.N. Mosél, C.A. Moser, B. Nimer, V. Petrov, H. Pollack *(Research)*, B. Reich, J.W. Robb, H.M. Sachar, B.M. Sapin, R.P. Sharkey, C.W. Shih, G. Sigur, H. Solomon, G. Stambuk, C.T. Stewart, Jr., R. Thornton, S.J. Wayne, H.B. Yakobson

Adjunct Professors T.F. Carroll, J.F. Coates, V.T. Coates, E.M. Hadley, J. Hardt

Professorial Lecturers J.J. Dziak, B. Ramundo, T.W. Wolfe

Associate Professors B.L. Boulier, J. Chaves, J.J. Cordes, C.F. Elliott, A.K. Fitzsimmons, C.J. Herber, W.R. Johnson, J.E. Kwoka, C.A. Linden, J.K. McDonald, H.R. Nau, G.A. Olkhovsky, E.O. Pederson, J. Pelzman, L.P. Ribuffo, A.M. Yezer, R.Y. Yin

Assistant Professors W.A. Anderson, M.A. Atkin, C.J. Deering, H.B. Feigenbaum, C.C. Joyner, D.L. Lee, C. McClintock, D. Pollock *(Visiting)*, R.W. Rycroft, M. Sodaro, G.C.Y. Wang, H.S. Watson, S. Wolchik

Committees†

DEAN'S COUNCIL

C.F. Elliott, J.R. Henig, P.P. Hill, H.C. Hinton, W.R. Johnson, D.L. Lee, W.H. Lewis, C.A. Linden, J.M. Logsdon, C. McClintock, J.A. Morgan, H.R. Nau, B. Nimer, V. Petrov, D. Pollock, B. Reich, S. Shaffer, G. Stambuk, R. Thornton

* The President of the University, the Vice President for Academic Affairs, the Registrar of the University, the Director of Admissions of the University, and the University Librarian are *ex officio* members of the Faculty of the School of Public and International Affairs.
† The Dean of the School is an *ex officio* member of all committees.

COMMITTEE ON PROGRAMS AND CURRICULUM

A. Gyorgy, O. Havrylyshyn, P.P. Hill, H.C. Hinton, H. LeBlanc, J.M. Logsdon, V. Petrov, G. Stambuk

COMMITTEE ON ADMISSION AND ADVANCED STANDING

B. Nimer, B. Reich, G. Stambuk, A.M. Yezer

COMMITTEE ON APPOINTMENTS AND PROMOTIONS

R.M. Dunn, P.P. Hill, D.L. Lee, J.M. Logsdon, B. Reich, G. Sigur, C.T. Stewart

COMMITTEE ON EAST ASIAN STUDIES

W.R. Johnson *(Chairman)*, H.C. Hinton, Y.C. Kim, C. Shih, G. Sigur, R. Thornton, R.Y. Yin

COMMITTEE ON RUSSIAN STUDIES

C.F. Elliott, A. Gyorgy, C.A. Linden, G.A. Olkhovsky, V. Petrov, M.J. Sodaro, R.B. Thompson, R. Thornton, S.L. Wolchik, H.B. Yakobson

COMMITTEE ON WORK-STUDY AND INTERNSHIP PROGRAMS

C.J. Deering, A.K. Fitzsimmons, P.F. Klarén

INTRODUCTION

With the establishment in 1898 of the School of Comparative Jurisprudence and Diplomacy, the study of government was first organized as a separate entity in the University. In 1928, this School was reorganized and broadened as the School of Government. During the next two decades, programs in business administration and public administration were added, and the emphasis gradually shifted from undergraduate to graduate study. The name was changed in 1960 to the School of Government, Business, and International Affairs to reflect more accurately the offerings of the School. A division of the School was effected in 1966, and two schools were established—the School of Government and Business Administration, a primarily professionally oriented school, and the School of Public and International Affairs, a primarily policy-oriented school.

Programs of the School of Public and International Affairs are interdisciplinary, and emphasize both domestic and foreign governmental policy. The School itself offers no courses but draws upon the course offerings of the various academic departments of the University.

Students in the freshman and sophomore years are registered in Columbian College of Arts and Sciences, the liberal arts college of the University, and are assigned special advisors from the School of Public and International Affairs to assist them in planning their programs.

Academic Programs

The School of Public and International Affairs offers undergraduate programs in Chinese Language and Literature, East Asian Studies (China or Japan), and Urban Affairs; undergraduate and graduate programs in International Affairs, Middle Eastern Studies, and Public Affairs; and gradu-

ate programs in East Asian Studies, Latin American Studies, Russian and East European Studies, Security Policy Studies, and Science, Technology, and Public Policy. Special programs in Soviet, Far Eastern, and East European Studies are offered by the School's Institute for Sino-Soviet Studies.

Objectives

Five undergraduate programs of study—East Asian Studies, Middle Eastern Studies, International Affairs, Public Affairs, and Urban Affairs—are aimed at preparing the student to understand major contemporary issues in international affairs or in domestic public affairs. The programs are designed not to produce narrow professional specialists, but to foster a liberal education, interdisciplinary in nature and broader than a concentration in one of the conventional disciplines. In each program there is double effort: to develop a background as broad and as deep as possible in order to assist in the understanding and analysis of modern problems and to give instruction in some useful tools of analysis. The program in Chinese Language and Literature is closer to the traditional liberal arts pattern, emphasizing language and culture.

The graduate programs leading to the degree of Master of Arts are more concentrated. The student is expected to develop a greater competence in an area or a discipline, building on the student's undergraduate program in preparation for professional employment in government, in international organizations, in business, or in private agencies concerned with public or international affairs.

REGULATIONS

Regulations concerning admission, registration, fees, and finances are stated on pages 19-32; other University regulations, on pages 44-52.

Attendance

Students may not attend classes until registration is completed and fees due are paid.

Students are held responsible for all the work of the courses in which registered, and all absences must be excused by the instructor before provision is made to make up the work missed.

A student suspended for any cause may not attend classes during the period of suspension.

Withdrawal

Withdrawal after the end of the fifth week of classes (fall or spring semester) without academic penalty is permitted only in exceptional cases (see "Withdrawal," page 47).

THE DEGREE OF BACHELOR OF ARTS

The School offers programs leading to the degree of Bachelor of Arts in the fields of Chinese Language and Literature, East Asian Studies (China or Japan), Middle Eastern Studies, International Affairs, Public Affairs, and Urban Affairs.

ENTRANCE REQUIREMENTS

The satisfactory completion of the Chinese Language and Literature, East Asian Studies, International Affairs, Public Affairs or Urban Affairs curriculum in Columbian College of Arts and Sciences (see pages 76-78), or the equivalent, is required.

GENERAL REQUIREMENTS FOR THE DEGREE

The following requirements apply to both the standard 120-semester-hour and the special 90-semester-hour programs. See pages 167-68 for additional requirements for the 90-semester-hour program.

Academic Work Load

Normal academic work load for the full-time student is 15 semester hours. A student with a strong academic record may take up to 18 semester hours with the approval of the dean.

Scholarship Requirements

In order to graduate, a student must have the following: (1) 120 semester hours (or 90 semester hours if the student qualifies for the special 90-semester-hour program) of passing grades (courses in human kinetics and leisure studies cannot be included in the required hours); and (2) grades of *A* or *B* in four three-semester-hour courses in the major, to be taken in residence at George Washington University. The major includes the required second-group courses (101-200) and courses taken in the group options.

DEAN'S HONOR LIST

The name of every student who attains a 3.50 quality-point index* in course work is placed on the Dean's Honor List for that semester. Appearance on the list will be limited to (1) full-time students registered for a minimum of 12 semester hours and (2) part-time students registered for a minimum of 12 semester hours over a period of two consecutive semesters, which may include a summer term.

ACADEMIC STANDING

A student who is not suspended or on probation is considered to be in good standing.

The rules below govern probation and suspension and are applicable as stated to students enrolled for a full-time program (12 semester hours or more) during the fall or spring semester or the three summer sessions. For students taking less than 12 semester hours in any one semester or summer session, these rules are applied on the basis of 12 or more hours taken during two or more semesters or summer sessions.

PROBATION

Students who in one semester receive two grades of *F*† in courses carrying

* See page 46 for explanation of the quality-point index.

† In determining whether a student is placed on probation or suspension, two grades of *D* are equated with one grade of *F*. Thus, for example, a student who receives one grade of *F* and two grades of *D* is placed on probation, and a student who receives two grades of *F* and two grades of *D* is suspended.

three or more semester hours of credit each, or the equivalent, are placed on probation. Those on probation who receive one grade of *F* in such a course will be continued on probation for a second semester. Those on probation taking 12 or more semester hours whose grades are all *C* or better are removed from probation.

SUSPENSION

The following three cases constitute grounds for suspension: (1) three grades of *F** in courses carrying three or more semester hours of credit or the equivalent; (2) two grades of *F* when on probation; (3) one grade of *F* when in a second semester of probation.

Students who are suspended for poor scholarship may apply for readmission after the lapse of one fall or spring semester. To be considered for readmission, the student must pass prescribed tests and submit evidence to the Dean's Council of conduct during absence from the University which indicates that the student will profit from readmission. Students readmitted after suspension are on probation. Those who are still on probation after completing 24 credit hours, will be suspended. A student suspended twice for poor scholarship will not be readmitted.

INCOMPLETE/AUTHORIZED WITHDRAWAL

Conditions under which the grades of *I* (Incomplete) or *W* (Authorized Withdrawal) may be assigned are described on page 45.

Removing an Incomplete—The grade of *I* must be removed no later than the last day of the examination period for the fall or spring semester immediately following the semester or summer session in which the grade of *I* is assigned. An "Incomplete" that is not removed within this period is automatically changed to an *F*. In cases of well-documented extenuating circumstances, an instructor and a student may jointly petition the dean, or the appropriate committee, for additional time in which to complete the work of the course. Such petitions should be submitted within the same period. The grade of *I* cannot be removed by reregistering for the course here or by taking its equivalent elsewhere.

Residence

A minimum of 30 semester hours, including at least 12 hours in the major field, must be completed while registered in the School of Public and International Affairs. This requirement applies to students transferring within the University as well as to students transferring from other institutions. Unless special permission is granted by the dean to pursue work elsewhere, the work of the senior or final year must be completed in the School of Public and International Affairs.

Use of Correct English

Any student whose written or spoken English in any course is unsatisfactory may be reported by the instructor to the dean. The dean may assign supplementary work, without academic credit, varying in amount with the

* In determining whether a student is placed on probation or suspension, two grades of *D* are equated with one grade of *F*. Thus, for example, a student who receives one grade of *F* and two grades of *D* is placed on probation, and a student who receives two grades of *F* and two grades of *D* is suspended.

needs of the student. If the work prescribed is equivalent to a course, the regular tuition fee is charged. The granting of a degree may be delayed for failure to make up any such deficiency in English to the satisfaction of the dean.

Study Abroad

Students wishing to study abroad must consult with their advisors and the dean, because arrangements must be made on an individual basis. Students should receive the dean's approval, in advance, for their plan of study abroad if they plan to have the credits earned abroad apply to the degree program in which they are registered. A catalogue or other description of the foreign institution or study program should be presented for consideration together with detailed descriptions of the courses to be taken. Students of international affairs are encouraged to travel and study abroad.

Pass/No Pass Option

A student in the School of Public and International Affairs who has a cumulative quality-point index* of 2.5 or better may, with the approval of the advisor and the dean, take one course each semester and receive a grade of *P*, Pass, or *NP*, No Pass, which will be recorded on the student's transcript but will not be reflected in the cumulative grade average. A student must sign up for such an option at registration. Under no circumstances may a student change from pass/no pass status to graded status, or vice versa, after the end of registration. Courses in the student's major (except those in which the grade of *P* or *NP* is normally assigned) may not be taken on a pass/no pass basis. A transfer student may not elect to take a course on a pass/no pass basis until the second semester of enrollment in the University. Students in the School of Public and International Affairs may take no more than six courses in which the grade of *P* or *NP* is assigned, including those in which the grade of *P* or *NP* is normally given and those taken in any other college, school, or division of the University prior to transferring to the School of Public and International Affairs.

Correspondence and Home-Study Courses

Credit for correspondence or home-study courses is not acceptable and cannot be applied toward a degree.

Additional Requirements for the 90-Semester-Hour Program

Exceptional students may, when registered as freshmen or sophomores in Columbian College of Arts and Sciences, petition the dean of the School of Public and International Affairs for admission to a special 90-semester-hour degree program in the School of Public and International Affairs. Supporting evidence in the form of achievement test scores, College-Level Examination Placement (CLEP) scores, and grades earned at George Washington University or any other institution must be supplied. The dean, in consultation with the Dean's Council, will determine eligibility for ad-

* See page 36 for explanation of the quality-point index.

mission to the program, which takes place when the student enters the School of Public and International Affairs at the beginning of the junior year.

The basic assumption of this program is that the student can waive at least 30 semester hours of freshman or introductory requirements.

In addition to the general and curriculum requirements, students in the 90-semester-hour program must fulfill the following requirements:

1. The student must receive grades of *A* in 50 percent of the total course work, and also in 50 percent of the courses required in the major.
2. The student must take at least 60 semester hours in courses beyond the first-group level (numbered above 100).
3. The 90 semester hours of credit must be earned in actual course work, i.e., credit through advanced placement, special examinations, etc., may not be counted in the 90 semester hours required for graduation.

Students who qualify for admission to the 90-semester-hour program are encouraged to begin taking second-group courses (numbered 101-200) as soon as they are qualified to do so, and should seek to obtain a waiver of course prerequisites in those disciplines in which they have a strong background.

CURRICULUM REQUIREMENTS

To be recommended by the faculty for graduation, candidates are required to complete, in addition to the appropriate freshman and sophomore work (see pages 76-78), a minimum of 60 semester hours during the junior and senior years, as set forth in one of the following curricula.

Earning Credit or Waiving Requirements by Examination

For information on earning credit or waiving curriculum requirements, see Columbian College of Arts and Sciences, pages 74-75.

Degree Programs

Requirements for the six programs of study leading to the degree of Bachelor of Arts are listed below. Students should consult the appropriate department in the "Courses of Instruction" section of this *Bulletin* for complete course descriptions.

CHINESE LANGUAGE AND LITERATURE

Prerequisite—A minimum of 60 semester hours in Columbian College (see page 76) or the equivalent from another accredited institution.

Requirements for the Major—Chin 11–12, 109–10, and 163–64; plus 12 additional semester hours of second-group Chinese literature courses. The student is required to pass a major examination at the end of the senior year. The coordinated field of knowledge upon which the student will be examined includes an active command of modern Chinese language and a general knowledge of Chinese literature and culture. A proseminar (Chin 199–200) assists the student in preparation for the major examination.

Students in the Chinese language and literature program may study abroad in the junior year.

EAST ASIAN STUDIES (China or Japan)

The major in East Asian Studies is designed to introduce the student to a non-Western culture and to provide an understanding of the history, poli-

tics, and economy of modern China or Japan. The major is interdepartmental and is recommended for students who wish a comprehensive study of one of the world's major civilizations and for those who contemplate graduate study in Chinese, Japanese, or Far Eastern affairs.

A junior year abroad is available in this program of study for those interested in China. Students should contact the chairman of the Department of East Asian Languages and Literatures.

Prerequisite—The East Asian Studies curriculum, page 77, including Chin 5–6 or Japn 3–4.

Requirements for the Major—(1) Chin 11 (China focus) or minimum of three additional hours of Japanese (Japan focus), and Chin 163 or 164; (2) Econ 169 (China focus) or 170 (Japan focus); (3) three semester hours selected from Geog 125, 126, 127, 132, 146, or 164; (4) nine hours selected from Hist 137, 187, 188, 189, 195, 196 (either Hist 187 or 196, but not both, may be selected); selection covering both pre-modern and modern periods encouraged; (5) PSc 170 or 173; (6) nine semester hours of course work in economics, history, or political science *not related* to China or Japan, to be selected in consultation with and approved by the advisor; six semester hours in research and writing seminar related to China or Japan and taken in discipline of concentration.

MIDDLE EASTERN STUDIES

The major in Middle Eastern Studies introduces the student to this region through interdepartmental studies.

Prerequisite—The Middle Eastern Studies curriculum, page 77.

Requirements for the Major—(1) six semester hours of a third year of a modern foreign language; (2) three hours of either religion, art, philosophy, or literature of the Middle East; (3) three semester hours selected from Geog 125, 126, 127, 132, 145, or 146; (4) six semester hours selected from Hist 107, 10 , 109, 110, 158, 193, or 194; (5) six semester hours selected from PSc 177, 178, 17 , or 180; (6) nine semester hours of course work in economics, history, or political science *not* related to the Middle East, to be selected in consultation with and approved by the advisor; six semester hours of research and writing seminar related to the Middle East and taken in the discipline of concentration.

INTERNATIONAL AFFAIRS

The major in International Affairs enables the student to specialize in international political relations, international economics, international communications, or regional studies.

Prerequisite—The International Affairs curriculum, page 77.

Requirements for the Major—(1) Econ 181–82; (2) six semester hours of a third year of foreign language (may be literature courses taught in the language); (3) three semester hours selected from Geog 125, 126, 127, 132, 135, 145, 146, or 161; (4) Hist 182 and one course selected from Hist 136, 150, or 157; (5) PSc 140 and 142 or 144; (6) 15 semester hours from one of the group options listed below:

Group I. International politics—courses concerned with theory and practice in international affairs, forces shaping the world scene, and American foreign policy, selected from Geog 125, 126, 127, 139, 146 (if not elected to satisfy the major requirement); Hist 137, 139–40, 149; PSc 105–6, 107, 108, 130, 131, 146, 149, 161, 178, 182, 191, 192 (PSc 142 or 144 may be elected if not taken to satisfy the major requirement).

Group II. International economics—courses concerned with the world economy and American policy and practice in international trade and finance, selected from BAd 176, 178; Econ 101, 102, 104, 121, 122, 134, 147, 151; Geog 125, 126, 127, 135; Stat 111, 112.

Group III. International communications—courses concerned with the study of international information programs, public opinion, psychological warfare, cultural relations and public relations, selected from Anth 150, 153, 157, 161, 162; Geog 106, 125; Jour 145, 146; PSc 120, 129, 146; Psyc 115, 151, 156; Soc 144.

Group IV. Regional study—a concentration in one of the following areas: (1) Africa—courses selected from Anth 178; Hist 116; PSc 180, 181, 182; (2) Europe—courses selected from Econ 147; Hist 128–29, 131–32, 141–42, 147, 149, 151–52, 159; PSc 105–6, 130, 131, 161; (3) Far East—courses selected from Anth 173, 175; Chin 163–64; Econ 169; Geog 164; Hist 137, 187, 188, 195–96; PSc 105, 170, 173; (4) Latin America—courses selected from Anth 170, 172, 185; Econ 185; Geog 161; Hist 163–64, 165, 166; PSc 183, 184; interdisciplinary seminar 287 (PSc 285) offered by six departments participating in the Latin American Studies program; (5) Middle East—courses selected from Anth 177; Hist 158, 193, 194; PSc 177, 178, 179, 180; Rel 161; or (6) Soviet Union and Eastern Europe—courses selected from Econ 133, 134; Hist 137, 143, 145, 146, 188; PSc 108, 131 or 165, 168; Slav 161–62, 165, 166, 193–94.

PUBLIC AFFAIRS

The major in Public Affairs deals with domestic government and policy.

Prerequisite—The Public Affairs curriculum, pages 77–78.

Requirements for the Major—(1) Econ 101, 161, 162; (2) Hist 175–76; (3) PSc 114 or 115, 116 or 117, 119; (4) 12 semester hours from one of the group options listed below:

Group I. Economics—courses selected from Econ 102, 104, 121, 122, 123, 136, 142, 165, 181–82.

Group II. Politics—courses selected from PSc 106, 110, 111, 112, 116 (if not taken as a major requirement), 118, 120, 121, 122, 124, 130, 146.

Group III. Urban affairs—courses selected from BAd 174; Econ 157; Geog 140, 141, 142; PSc 111, 112; Soc 126; U&RP 153.

URBAN AFFAIRS

The Urban Affairs program is designed for undergraduates interested in urban-related occupations, in furthering their knowledge about theories and findings related to urban life, or in acquiring the tools that will help them to effectively apply themselves to the task of devising solutions to the problems that cities and their residents face. The program consists of a focused set of courses that introduces the student to the problems and issues of urban America from the perspectives of various social science disciplines.

The central focus of the program is on urban public policy—the various forces that shape it, and its adequacy relative to current and anticipated needs. Within the overall framework, students can specialize in either the political and social, economic and financial, design, or research methodological aspects of urban studies. In the senior year each student serves an internship in an urban-related agency or research organization and also attends a weekly seminar restricted to urban affairs majors. Each student is encouraged to work closely with the urban affairs advisor to develop a program tailored to personal interests and goals.

Prerequisite—The Urban Affairs curriculum, page 78.

Requirements for the Major—(1) Urban Affairs core courses: Econ 157; Geog 140; Hist 186; PSc 101, 111, 112; and one course chosen from among Stat 51, 53, or 111. (2) Special Urban Affairs fields: each student will be required to take

four courses from within one of the following four fields of specialization, and two courses from each of the others. Field A. (Urban Research Methods): Stat 51, 53, or 111; Stat 112, 97, 105, 117, 123; Acct 115. Field B. (Political and Social Urban Analysis): PSc 104, 111, 113, 124; Soc 126 and 128; Soc, Econ 153; PAd 190. Field C. (Urban Economics and Financial Analysis): Econ 101, 136, 161, 162, 165; BAd 113. Field D. (Urban Design and Spatial Analysis): AmCv 177; Geog 141, 142, 143; U&RP 153, 201. (3) Senior Internship and Seminar: PSc 188 and 193—the grade of *P* (Pass) or *NP* (No Pass) will be given for PSc 188. A student may elect to fulfill the internship requirement in a paid position in lieu of registering for PSc 188; however, the student must substitute six semester hours of elective course work.

THE DEGREE OF MASTER OF ARTS

The School offers degree programs leading to the Master of Arts in the fields of East Asian Studies, International Affairs, Latin American Studies, Middle Eastern Studies, Public Affairs, Russian and East European Studies, Security Policy Studies, and Science, Technology, and Public Policy.

ADMISSION REQUIREMENTS

Application forms are available from the Office of Graduate Admissions, School of Public and International Affairs, George Washington University, Washington, D.C. 20052.

A bachelor's degree from an accredited college or university, with a *B* average or better, or the equivalent, in the relevant undergraduate major, is normally required. If there is evidence of special promise, such as high Graduate Record Examination scores, an applicant whose academic record falls short of *B* will be given serious consideration. Scores on the Aptitude Test of the Graduate Record Examinations as well as letters of recommendation are required.

In East Asian Studies—An undergraduate major in a pertinent field is required. For the concentration in Chinese language and literature, the undergraduate program should include 24 semester hours of Chinese language study.

In International Affairs—The applicant's undergraduate program should include background courses corresponding to the interdepartmental undergraduate major in international affairs at this University or some other relevant social science program. In the case of major deficiencies in the social sciences or international relations, additional course work may be specified beyond the minimum requirements for the master's degree. The student's particular responsibilities will be indicated in the letter of admission to the program and in the course of subsequent consultation with an assigned faculty advisor.

In Latin American Studies—The applicant's undergraduate program should include background courses corresponding to an undergraduate major in Latin American Studies at this University or equivalent. Majors in other fields may be considered for admission provided that undergraduate course work includes Spanish or Portuguese and sufficient course work in one of the following six areas: anthropology, economics, geography and regional science, Hispanic literature, history, and political science.

In Middle Eastern Studies—The applicant's undergraduate program

should include background courses corresponding to an undergraduate major in Middle Eastern Studies at this University or equivalent.

In Public Affairs—An undergraduate major in public affairs, economics, history, or political science, depending upon the field of specialization in the master's program, is required. Students entering the program are assumed to have had some college-level course work in American government and politics, American history, and economic theory. To the extent that a student lacks such a background, the student must, in consultation with an advisor, undertake the appropriate remedial course work, including some courses which may be taken for graduate credit.

In Russian and East European Studies—An undergraduate major in a pertinent field is required. The undergraduate program should include the following courses, or equivalent: Hist 145, 146; PSc 131 or 168; Slav 1–2 and 3–4, or 5–6.

In Science, Technology, and Public Policy—Undergraduate majors in a social, life, or physical science, or in engineering are eligible for admission, although those lacking adequate preparation in relevant social sciences, particularly economics, may be required to take additional courses; such requirements will be indicated in the letter of admission to the program.

In Security Policy Studies—An undergraduate background similar to that specified above for International Affairs would be appropriate. Working experience in the military or national security fields might compensate in part for inadequate academic preparation. A background in economics or quantitative analysis skills would also be helpful.

Readmission

A graduate student who has not been continuously enrolled, or on approved leave of absence or inactive status, must file an application for readmission the semester before planning to return to school. Applications for readmission are reviewed by the dean and the Committee on Admission.

GENERAL REQUIREMENTS

There are two options available in all programs leading to the Master of Arts degree except Security Policy Studies, in which only the nonthesis option is available, and East Asian Studies (with a concentration in Chinese language and literature), in which only the thesis option is available. One option requires a minimum of 24 semester hours of approved graduate work plus the successful completion of a thesis; the student must register for six semester hours of *Thesis Research* (299-300). The second option requires a minimum of 36 semester hours of graduate course work and does not include a thesis. The course work for both options is taken in preparation for the Master's Comprehensive Examination.

Candidates for the degree of Master of Arts are required to submit an advisor-approved "Program of Studies" (comprehensive fields, supporting course work, tool requirement, etc.) to the office of the dean by the end of the first semester in residence.

Master's degrees are awarded by vote of the Faculty after the student has completed the required course work and an acceptable thesis (if one is elected), has satisfied the foreign language or tool requirement, and has passed the Master's Comprehensive Examination.

Under special circumstances second-group courses (numbered 101-200) may be counted toward the master's degree when registration for graduate credit has been approved at the beginning of the course by the curriculum advisor, the instructor and the dean. The student who takes an undergraduate course for graduate credit is expected, by arrangement with the instructor, to do work at the graduate level in addition to the regular work of the course. Normally, no more than six semester hours of second-group courses may be taken for graduate credit in the 30-semester-hour program, and no more than nine semester hours may be taken for graduate credit in the 36-semester-hour program. (The one exception to this rule is the case of students who select one or more fields in history; they may take nine hours of second-group courses in the 30-hour program and 12 in the 36-hour program.) No work counted toward a bachelor's degree may also be counted toward a master's degree.

All work for a master's degree must be completed in five years, unless an extension of time is granted by the dean. A student who is temporarily unable to continue the program of studies may request a leave of absence not to exceed one year.

No credit is granted for work done *in absentia* or without formal instruction, except for the thesis, which may be completed *in absentia* with the permission of the curriculum advisor and the dean. No more than six semester hours of graduate credit may be transferred from other accredited institutions or another division of the University, and these may be accepted only under limited conditions of time, grades, and relevance to the student's program.

Tool Requirements

In most programs of study a candidate for the degree of Master of Arts must demonstrate a reading knowledge (certified by the appropriate language department) of at least one modern foreign language, to be approved by the dean. A master's degree candidate whose native language is not English may not select the native language to meet the tool requirement; the candidate may select English to fulfill the requirement with the approval of the advisor and the dean. The examination, which will test high-level reading and writing proficiency, is administered by the English for International Students program.

Candidates in the fields of Public Affairs, Security Policy Studies, and Science, Technology, and Public Policy may substitute statistics for a foreign language. This requirement may be met by demonstration of proficiency at the level of Stat 105, 112, or 197.

Candidates in International Affairs may petition the dean to substitute statistics for a foreign language. The primary basis for approving such petitions will be the relevance of the statistical skills to the student's thesis research.

The language or tool examination should normally be taken before the student has completed the first 15 hours of work; it must be taken before the comprehensive examination. No student may take the language or tool examination more than three times.

Courses taken to fulfill the tool requirement are not counted in the semester-hour requirement for a master's degree.

Master's Comprehensive Examination

In addition to any course examinations, the candidate must pass a written Master's Comprehensive Examination. Examinations are scheduled twice a year (usually in November and April), and should be taken during the last semester of course registration or shortly after the completion of the prescribed course work. If there is a lapse of time between completion of course work and the examination, the student must be enrolled continuously during this period. The candidate must consult with the advisor, well in advance, as to the date of the examination and the definition of the subject-matter fields which this examination is to cover. It should be understood, however, that course work constitutes only partial preparation for the Master's Comprehensive Examination. Each student is also expected to pursue a program of additional reading in each of the selected fields, in accordance with the advice of the faculty member responsible for instruction in that field. An oral examination on the thesis or major report may also be required.

Scholarship Requirements

Grades for graduate work are *A*, Excellent; *B*, Good; *C*, Minimum Pass; *F*, Fail; *CR*, Credit; *I*, Incomplete; *IP*, Progress; *W*, Authorized Withdrawal; and *Z*, Failure, Unauthorized Withdrawal.

An average of *B* or better is required for the master's degree. The grade of *C* is not considered as failing but must be counterbalanced by a grade of *A* in a graduate course of equal status.

A master's candidate who receives a grade of *F* is required to present cause for consideration by the Dean's Council as to why the student should be allowed to continue in the program of studies.

Whenever a grade has not been assigned, the symbol *I* (Incomplete) or the symbol *W* (Authorized Withdrawal) will be recorded. The symbol *I* indicates that a satisfactory explanation has been given to the instructor for the student's failure to complete the required work of the course. Except for thesis research courses, an "Incomplete" cannot be made up after the lapse of one calendar year. An "Incomplete" which is not removed by the end of one calendar year remains as a grade of *I* on the student's record. An "Incomplete" cannot be removed by reregistering for the course. No student will be permitted to register for courses in a new academic year, or take the Comprehensive Examinations, if there are more than two "Incompletes" outstanding on the record.

A student who fails to meet the established deadlines for completion of course work or other elements of the program (e.g., comprehensive examinations) and is granted an extension may be required by the Dean and the Dean's Council to register for three credit hours of graduate "Reading and Research" for each semester that the work is delinquent.

The Thesis

The thesis subject should be selected as early as possible so as to permit effective integration with the course work. A student will not be permitted to register for Thesis Research (299-300) until the thesis subject has been formally submitted to the Dean's Office. The subject must be approved by the student's advisor and the member of the Faculty under whom the

thesis is to be written. The thesis in its final form must have the approval of the thesis director and one other reader, and two copies must be presented to the dean by the student no later than the date announced in the Calendar. Printed copies of detailed regulations regarding the form and reproduction of the thesis are available in the Dean's Office.

Payment of tuition for the thesis entitles the candidate, during the period of registration, to the advice and direction of the thesis director and the other reader. In case a thesis is unfinished, the student must maintain continuous enrollment, and is allowed one calendar year to complete it. If the preparation of the thesis extends beyond the additional calendar year, the student must register for the enire six hours of thesis again and pay tuition as for a repeated course.

Degree Programs

Specific requirements for each of the eight degree programs leading to the Master of Arts are listed below. For prerequisites, see "Admission Requirements," above.

EAST ASIAN STUDIES

The Master of Arts in the field of East Asian Studies is an interdisciplinary program which includes course work from at least four of the following disciplines: Chinese language and literature, economics, geography, history, and political science.

The degree program consists of 30 semester hours of course work, including six hours of thesis research, or 36 semester hours of course work without a thesis. Each candidate must pass a Master's Comprehensive Examination in one major and one or two minor fields. To fulfill the tool requirement candidates must demonstrate proficiency in either Chinese or Japanese language; with the permission of the dean, another East Asian language may be substituted. (As preparation for this requirement, a special Chinese language course will be available to students in the program.)

Only the 30-semester-hour thesis option is available to students selecting a concentration in Chinese language and literature. That program includes 12 semester hours of Chinese language and literature, six hours of history, six hours of electives selected in consultation with the advisor, and six hours of thesis research.

INTERNATIONAL AFFAIRS

The interdisciplinary program leading to the degree of Master of Arts in the field of International Affairs provides the student with a wide choice of fields within three broad areas of study: general, supplemental or special, and regional. Graduate courses in anthropology, business administration, economics, geography and regional science, history, political science, psychology and sociology relate to these fields, which are listed below:

General Fields of Study—International politics, comparative government and politics, modern political theory (including socialist and communist theory) and international economics.

Supplementary or Special Fields—International law; international organization and administration; international economic development; international and comparative aspects of communism; U.S. diplomatic history;

U.S. foreign policy; science, technology, and public policy; 20th century British defense and foreign policy; and U.S. national security policy.

Regional Fields—Modern history, or government and politics, or economic history and problems of one of the following: Western Europe, Eastern Europe, the Soviet Union, Latin America, the Middle East, Africa, South and Southeast Asia, Japan, and China. Within each geographical area there are normally three fields of study available.

Each degree candidate must select at least one general field. The fields should also represent at least two disciplines. Beyond these limits, the student is free to select any of the fields indicated above as long as they comprise a coherent program. Courses should be chosen with a view to their relevance to the selected fields. Candidates will be examined on their selected fields of study in the Master's Comprehensive Examination.

Candidates who elect to write a thesis must choose *three* of the listed fields and take, in addition to the thesis, a minimum of 24 semester hours of graduate course work in at least two departments, with no more than 15 hours in any one department.

Candidates electing a program without a thesis must choose *four* fields and may take no more than 21 of their required 36 semester hours in one department. They must also include in their program at least two research seminars (six semester hours) requiring the preparation of substantial research papers.

LATIN AMERICAN STUDIES

The program leading to the degree of Master of Arts in the field of Latin American Studies is designed to provide the student with an appropriate area background in three or four of the following fields: anthropology, economics, geography and regional science, Hispanic literature, history, and political science.

All degree candidates must complete 12 semester hours of graduate work, including the interdisciplinary seminar (287), in a major field selected from those listed above, and six semester hours in each of two minor fields selected from those listed above. Students who elect not to write a thesis, must take six semester hours in a third minor field selected from those listed above, or from the fields of urban and regional planning, economic development or population studies. The student must further complete an additional six semester hours in any of the major or minor fields selected. The tool requirement must be satisfied by demonstration of proficiency in Spanish or Portuguese, or in English if the student's native language is Spanish or Portuguese. The Master's Comprehensive Examination will cover all the student's selected fields.

MIDDLE EASTERN STUDIES

The interdisciplinary program leading to the degree of Master of Arts in the field of Middle Eastern Studies offers the student an appropriate area background in three or four of the following fields: domestic politics, international relations, history, economics, geography and regional science, anthropology, religion, philosophy, art, and literature. One approved field from the international affairs curriculum may also be included.

The degree program consists of 30 semester hours of course work including six hours of thesis research, or 36 semester hours of course work

without a thesis. In the 30-hour program, students select one major and two minor fields; in the 36-hour program, students chose one major and three minor fields. Written Master's Comprehensive Examinations in these fields will be required of all candidates at the completion of the degree program. All students must meet the prescribed basic preparation of three credit hours in Middle Eastern international relations, domestic politics, and modern history, and must satisfactorily complete the interdisciplinary seminar offered by this program. To fulfill the tool requirement, candidates must demonstrate reading knowledge proficiency in an approved modern Middle Eastern language.

PUBLIC AFFAIRS

The program leading to the degree of Master of Arts in the field of Public Affairs allows the student to specialize in either domestic economics or domestic politics. The student may select courses in consultation with an advisor to emphasize either political science, economics, or American history, provided (1) that no more than 15 hours of courses are elected in one department under the 24-hour program with a thesis, or (2) that no more than 21 hours are elected in one department under the 36-hour program without a thesis. Course work may include economics (public finance, monetary theory and policy, labor economics, industrial organization, natural resources and environmental economics, regional and urban economics, economic policy); history (U.S. political history, U.S. economic history, recent U.S. history); political science (domestic politics and government, Congress and the presidency, U.S. constitutional law and politics, state and urban politics, political science research methods, and science, technology, and public policy).

RUSSIAN AND EAST EUROPEAN STUDIES

This degree program is designed to give the student a broad grasp of Russian and East European affairs on an interdisciplinary basis, with emphasis on the period since 1917. The program provides an opportunity for students to gain knowledge of special areas of interest from among the following: Soviet internal and external affairs (required field of study), Soviet and Eastern European economics, ideology and thought, Russian literature and culture, Soviet military policy and strategy, 19th-century Russian history, comparative and international aspects of communism, Eastern European history, Eastern European government and politics, and advanced Soviet government, politics and foreign policy.

The degree program consists of 30 semester hours including 6 hours of thesis research, or 36 semester hours of course work without the thesis. All students must take 6 to 9 hours in the interdisciplinary field covering Soviet internal and external affairs. In the 30-hour program, students select two other fields and must include one course in Eastern European history or politics; in the 36-hour program, students select three other fields and must include one field in Eastern European history or politics. All candidates will be required to take Master's Comprehensive Examinations in these fields. Before the Comprehensive Examinations can be taken, Russian language proficiency must be demonstrated in a reading comprehensive examination. All students must have the required background preparation of at least 9 credit hours in Russian history and Soviet government and politics, and 12 credit hours in Russian language study.

Students in the concentration in Russian literature and culture may take either the thesis or non-thesis option. They must take the required field in Soviet internal and external affairs in addition to the selected fields in literature and culture. The approved fields include 19th-century Russian literature, Soviet literature, and Russian culture.

SCIENCE, TECHNOLOGY, AND PUBLIC POLICY

The program leading to the degree of Master of Arts in the field of science, technology, and public policy is flexible and is carefully planned and conducted in consultation with an advisor. All degree candidates are required to take 12 semester hours in the core field of science, technology, and public policy, which includes course work both in science policy and in policy analysis. A second field must be chosen from one currently offered in the international affairs or public affairs programs of the School. Students who elect to write a thesis must select one additional field, and those who elect not to write a thesis must select two additional fields. The third and fourth fields may also be chosen from those currently offered in international affairs or public affairs, or may be interdisciplinary, developed in consultation with the advisor and focusing on a particular policy issue or area. Such a special field must be approved by the student's advisor and the dean.

SECURITY POLICY STUDIES

The 36-hour, four-field program leading to the degree of Master of Arts in the field of security policy studies is explicitly policy-oriented, and professional in the sense of attempting to prepare students for policy-oriented positions in the defense/national security field. A student's degree program will be carefully planned with an advisor. All degree candidates are required to take 12 semester hours in the core field of defense policy analysis. In addition, students should have a minimum competence in economics equivalent to Econ 217-18. At least one field should be selected from among the following: international security policy; military history; history of strategic thought; Soviet military policy and strategy; science, technology, and public policy; and advanced quantitative analysis. The remaining two fields are to be selected from any of the above, or from any other field offered in the School's various programs. The tool requirement must be satisfied by demonstration of proficiency in statistics or a foreign language.

SPECIAL PROGRAMS

Combined Master of Arts and Juris Doctor Degree Program

The School of Public and International Affairs cooperates with the National Law Center in offering a program leading to the combined degrees of Master of Arts and Juris Doctor. A student must be accepted for admission by both the School of Public and International Affairs and the National Law Center. Applications should be made separately, but at the same time. Both the School and the Center should be notified that the student is interested in the combined program. The student will be admitted to the School of Public and International Affairs for the academic

year following the first year of study at the National Law Center, since the National Law Center stipulates that the first year of course work for the Juris Doctor degree must be taken as a unit.

The Master of Arts degree program normally consists of the 30-semester-hour program which includes a thesis. The student selects a major offered by the School and fulfills all of the requirements for the Master of Arts degree as well as fulfilling the requirements for the Juris Doctor degree. Up to six semester hours of credit for course work completed as part of the Juris Doctor curriculum and related to the student's degree program may be approved for transfer toward the Master of Arts degree. (Some of the course work required for the Master of Arts degree program may be applicable toward the Juris Doctor degree requirements.) Students will be registered in both the School of Public and International Affairs and the National Law Center and must maintain this concurrent registration until all degree requirements have been completed. All work for this combined degree program must be completed in five years, unless an extension of time is granted by the dean.

Institute for Sino-Soviet Studies

The Institute for Sino-Soviet Studies provides a program of specialized graduate study and research within the School of Public and International Affairs. Courses of the Institute are drawn from a variety of academic areas and thus provide an interdisciplinary approach to the study of the Soviet Union, Eastern Europe, and East Asia, and of the Communist movement within and among the countries of these areas. Faculty members conduct seminars and reading courses in the disciplines of economics, geography, history, language and literature, law, political science, and psychology. Research work is integrated with the teaching program.

Students who are preparing for the degree of Master of Arts in the fields of East Asian studies, international affairs, and Russian and East European studies in the School of Public and International Affairs, or for the degree of Master of Arts in the fields of economics, history, or political science in the Graduate School of Arts and Sciences, with specialization in Sino-Soviet studies, may take course work from the Institute's offerings.

Doctoral candidates in the field of political science will take their Sino-Soviet work in the form of appropriate subfields of the major and minor fields. Doctoral candidates in the field of history are expected to take at least two of the four fields for the degree in the history of the countries of their specialization. All work leading to the degree of Doctor of Philosophy is under the general supervision of the Graduate School of Arts and Sciences and consultative committees designated by that School which direct the work of each graduate student upon admission to degree candidacy. A faculty member of the Institute will serve as advisor to the candidate. The candidate's committee will be formed from members of the selected disciplinary department. A candidate for such a degree should assume that the committee will require the substitution of a reading examination in Chinese or Russian for one of the two Western languages normally required for the degree.

A brochure describing in more detail the work of the Institute is available upon request.

DIVISION OF CONTINUING EDUCATION AND SUMMER SESSIONS

Dean W.F.E. Long
Associate Deans A.C. Jensen, S.R. Paratore
Assistant Deans G.E. Jones, B.J. Moreland, J.H. Pappalardo, A.O. Smith

INTRODUCTION

The Division of Continuing Education and Summer Sessions recognizes the importance of continuing education to the community. The Division assists in providing continuing education programs for adult students by administering or coordinating the off-campus offerings of the colleges and schools of the University, at both the undergraduate and graduate levels. Also offered are off-campus credit courses for the nondegree student seeking personal enrichment or the updating and upgrading of professional credentials. Special programs of study are developed in cooperation with other colleges and schools of the University in response to specific needs of the government and business community. The Division also develops and conducts noncredit courses, seminars, and workshops, drawing on the resources of the University.

The staff of instruction for Division programs includes members of the full-time faculty of the University and academically qualified part-time lecturers from the professional community.

The Division works closely with education directors, public school officials, and personnel administrators in government, business, and industry to develop courses of study for mature students. In cooperation with sponsoring groups from government and business, the Division offers courses at off-campus centers throughout the District of Columbia and in suburban Maryland and Northern Virginia. The Division also offers, through its Tidewater Center, graduate degree programs in various disciplines at locations in the Hampton, Norfolk, and Virginia Beach areas. A wide range of seminars and workshops is available to organizations and individuals from the professional community.

Any organization interested in having the Division organize and conduct a course or a comprehensive educational program should contact the Division of Continuing Education and Summer Sessions.

The academic standards of the University are maintained in off-campus credit courses. The Division of Continuing Education and Summer Sessions is accredited by its regional accrediting agency, the Middle States Association of Colleges and Secondary Schools. All programs offered through the University's off-campus programs and administered by this Division are approved through the procedure authorized by the Board of Trustees and the Charter granted by the Congress of the United States. Degrees are granted through the faculties of the degree-granting schools and colleges of the University. Credit earned through off-campus study conforms to academic standards throughout the University. All Division off-campus offerings in Maryland are approved by the Maryland State Board for Higher Education; those in Virginia are approved by the Commonwealth of Virginia Council of Higher Education.

Except as outlined below, all general University regulations apply to students in the Division of Continuing Education and Summer Sessions. In addition, Division students are subject to all special requirements of the school through which they are taking courses.

ADMISSION AS A DEGREE CANDIDATE IN OFF-CAMPUS PROGRAMS

Students wishing to be admitted as candidates for one of the off-campus undergraduate or graduate degree programs of George Washington University may obtain application forms from the Division of Continuing Education and Summer Sessions, one of the University's off-campus representatives, or the education officer of their agencies or installations.

Mature students who do not meet University admission requirements (pages 19-26) may be considered for degree candidacy after the satisfactory completion of at least 15 semester hours of course work with a grade-point average of 2.00 or better. This must include courses in English composition (Engl 9 or 10 and 11) and 9 semester hours of course work in at least two of the following areas: humanities (literature, philosophy, foreign language), social sciences (anthropology, economics, geography, history, political science, psychology, sociology), and natural and mathematical sciences.

NONDEGREE STUDENTS

Off-campus credit courses may be taken by nondegree students who meet the prerequisites prescribed by the department concerned. Formal University admission is not required for registration.

CHANGES IN PROGRAM OF STUDIES

DROPPING AN OFF-CAMPUS COURSE

A course may be dropped without academic penalty during the first third of the semester. Withdrawing from a course without academic penalty after this period requires approval of a written request, *accompanied by a completed Change Slip*, addressed to the Dean of the Division of Continuing Education and Summer Sessions. An off-campus Change Slip (obtainable from the instructor or from the Division) must be completed, signed by the student and the instructor, and submitted to the Division. The instructor will indicate on the Change Slip whether or not the student is passing. Merely reporting a withdrawal to an instructor does not constitute official withdrawal from a course. The effective date of withdrawal will be determined by the appropriate dean. A refund, if appropriate, will also be indicated by the dean.

Failure to follow the proper procedure will result in a grade of Z and, regardless of the date of discontinuance, will not relieve the student of financial responsibility for the entire course.

DEGREE PROGRAMS

Columbian College of Arts and Sciences offers the following degree programs off campus:

Associate in Arts in General Studies
Associate in Science in Cartographic Science
Associate in Science in Geodesy
Bachelor of General Studies
Bachelor of Science in Cartographic Science
Bachelor of Science in Geodesy

The Graduate School of Arts and Sciences offers the following degree programs off campus:

Master of Arts in Special Studies or Master of Science in Special Studies
Major Fields: Crime in Commerce, Criminal Justice, Employment Policy, Energy Policy, Environmental Science, Legislative Affairs, Regulatory Policy, Social and Organizational Behavior, Telecommunications Policy
Master of Arts in the field of Administrative Science
Master of Forensic Sciences

The School of Engineering and Applied Science* offers the following degree programs off campus:

Master of Engineering Administration
Master of Science
Major Fields: Computer Science, Electrical Engineering, Operations Research, Systems Analysis and Management
Professional Degrees (Engineer and Applied Scientist)

The School of Education and Human Development offers the following degree programs off campus:

Bachelor of Arts in Education and Human Development
Major Fields: Human Services, Special Education: Complementary Teacher Program
Master of Arts in Education and Human Development
Major Fields: Elementary Education, Secondary Education, Reading Supervision and Human Relations, Higher Education, Human Resource Development, Adult Education, Early Childhood Special Education, Vocational/Special Education
Education Specialist

COLUMBIAN COLLEGE OFF-CAMPUS PROGRAMS

Through the Columbian College of Arts and Sciences, the Division of Continuing Education and Summer Sessions offers associate's and bachelor's degree programs in General Studies, Cartographic Science, and Geodesy. Further information about these programs, which are described below, is available from the Division or from Columbian College.

Requirements for the Associate's Degrees

RESIDENCE

The last 15 semester hours must be completed in residence as a candidate for the Associate's degrees. A portion of the academic work taken to qualify for degree candidacy may be accepted in partial satisfaction of the residence requirement, if the courses are approved as part of the student's degree program.

*See the School of Engineering and Applied Science Bulletin.

Requirements for the Bachelor's Degrees

RESIDENCE

A minimum of 30 semester hours, including at least 12 hours in the area of concentration, must be completed in residence as a candidate for the degree sought. Unless special permission is granted by the appropriate dean to pursue work elsewhere, the work of the senior year must be completed in residence. This requirement applies to students transferring within the University as well as to students transferring from other institutions. The 15 hours taken in order to be considered for degree candidacy may be counted in residence. For regulations governing military students who are transferred when they are within six semester hours of their degrees, see pages 186-87.

Associate in Arts in General Studies

Faculty Advisor Debra Bearman

Upon the satisfactory completion of the requirements set by Columbian College of Arts and Sciences, the degree of Associate in Arts in General Studies is conferred. Students who plan to continue working toward an off-campus bachelor's degree offered by Columbian College must apply to the Division's Office of Student Services upon completion of the requirements for the degree of Associate in Arts in General Studies. Forms for this purpose are available from the Division office.

After completing the degree requirements, students may wish to transfer to an on-campus degree program within the University, or they may wish to transfer to another institution. However, modifications in admission, advanced standing, and curriculum requirements permitted in the Associate in Arts in General Studies degree program may not be accepted in transfer. Therefore, while registered for this degree, students should meet the requirements of the college, school, or university to which they may wish to transfer.

Scholarship—The system of grading is described on page 45. For regulations concerning probation, suspension, and readmission, see pages 68-69.

CURRICULUM

The satisfactory completion of 60 semester hours of college work in the following curriculum is required. Students who plan to pursue a bachelor's degree are advised to plan their program so that they will have satisfied prerequisites toward a bachelor's degree of their choice.

		Semester Hours
Communications:	Engl 9 or 10, 11	6
	SpDr 1, 11, 111, or 121	3
Humanities:	Nine semester hours selected from the following: Art 31–32, 71–72; Engl 43–44, 45–46, 51–52, 71–72; Mus 3, 4; Phil 50; Rel 9, 10, 59, 60	9
Math/Science:	Three courses selected from the following: BiSc 3–4, 11–12; Chem 3–4, 5–6; Geol 1–2, 3, 4; Math 3, 6, 9, 10, 30, 31, 41, 42, 51, 52; Ocea 103–4; Phys 1, 2, 3, 4, 9–10; Stat 51, 53, 97, 101–2	9–12

		Semester Hours
Social Sciences:	Nine semester hours are required, each course chosen from one of two departments, selected from the following: AmCv 71–72; Anth 1–2; Econ 1–2; Geog 1, 2; Hist 39–40, 71–72; PSc 1, 2; Psyc 1, 8, 22, 29; Soc 1, 2	9
Elective:		21–24
	Total	60

Bachelor of General Studies

Faculty Advisor Debra Bearman

The Bachelor of General Studies curriculum aims to provide the adult part-time student with the opportunity to obtain a broad education. For that reason the course work required in the first and second years is distributed among communications (written and oral), the humanities, natural and mathematical sciences, and the social sciences. In choosing the third- and fourth-year course work required in departments related to their concentration, students should obtain counseling through the faculty advisor.

Students planning to work toward master's degrees are advised to plan their bachelor's programs so that they will meet the prerequisite requirements of the school or college of their choice. Students planning to enter graduate programs which require a reading knowledge of a foreign language are advised to include two years of a foreign language in their bachelor's program.

Scholarship—To qualify for graduation, 120 hours of course work must be passed and an index achieved of 2.00 based on courses graded on a four-point scale. At least 60 hours of course work, including the general course requirements, must be taken outside the major department or program.

Students must also achieve no lower than the grade of *C* in required courses in the selected area of concentration. A *D* in a required course will satisfy a curricular requirement in the area of concentration and may count toward the total 120 hours, but it shall not count toward the minimum number of hours required in the area of concentration.

The system of grading is described on page 45. For regulations concerning probation, suspension, and readmission, see pages 68-69.

FIRST AND SECOND YEARS

Communications:	Engl 9 or 10, 11	6
	Engl 20	3
	SpDr 1, 11, 111, or 121	3
*Humanities:	Twelve semester hours selected from the following: Art 31–32, 71–72; Engl 43–44, 45–46, 51–52, 71–72; two years of one foreign language; Mus 3 and 4; Phil 50; Rel 9 and 10, 59, 60; Slav 91–92	12

* Students who plan to continue study for advanced degrees are urged to fulfill the two-year language option.

		Semester Hours
Math/Science:	Six to eight semester hours selected from the following: BiSc 3–4, 11–12; Chem 3–4, 5–6; Geol 1–2, or 3 and 4; Ocea 103–4; Phys 1 and 2, or 3 and 4, or 9–10 ..	6–8
	Six to eight semester hours selected from the following: Math 3, 6, 9, 10, 30, 31, 41, 42, 51, 52; Stat 51, 53, 97, 101–2	6–8
Social Sciences:	Twelve semester hours selected from two of the following combinations: AmCv 71–72; Anth 1–2; Econ 1–2; Geog 1, 2; Hist 39–40, 71–72; PSc 1, 2; Psyc 1 and 8, 22, or 29; Soc 1, 2	12
Electives:	(depending on science option)	8–12
		60

THIRD AND FOURTH YEARS

Concentrations are offered in economics, history, mathematics, political science, psychology, and sociology. Concentration requirements are to be selected in consultation with the academic advisor. Students selecting economics, history, mathematics, or political science are required to complete 24 semester hours of 100-level courses in their area of concentration, and 18 semester hours of courses, selected in consultation with the faculty advisor, in two or more related departments.

Students selecting psychology or sociology are required to complete 18 semester hours of 100-level courses in their area of concentration, and 24 semester hours of courses, selected in consultation with the faculty advisor, in two or more related departments. The remaining 18 credit hours required for graduation may be in elective courses.

Associate in Science in Cartographic Science
Associate in Science in Geodesy
Bachelor of Science in Cartographic Science
Bachelor of Science in Geodesy

Faculty Advisor Hyman Orlin

The course work in these two- and four-year curricula is offered both on and off campus. However, the cartography and geodesy courses are given only at selected off-campus locations.

GENERAL REQUIREMENTS

The Associate's degree programs require satisfactory completion of 60 semester hours; the Bachelor's degree programs, 120 semester hours. All candidates for the Bachelor of Science degrees in Cartographic Science and in Geodesy will pursue a general arts and sciences curriculum until they begin work in their major field; they must complete the two general course requirements listed below. Candidates for the Associate degrees must complete the English requirement (#1) below. Except for the general course requirements, all curriculum requirements are established by the major field program.

The two general requirements are the following:

1. Each student must, during the freshman year, demonstrate adequate achievement in the field of English composition, either by examination

or by taking English 9 or 10, and English 11 or 12. This requirement may not be postponed; it applies to the Associate's and Bachelor's degrees.

2. Each student in the Bachelor's degree programs must at some point in the college career undertake a meaningful initiation into the three divisions of knowledge: humanities, natural and mathematical sciences, and social sciences. As each major field will represent one of these three areas, the requirement must be fulfilled by taking no less than six semester hours in each of the other two areas (see pages 71-72).

Servicemember's Opportunity College

George Washington University has been designated a Servicemember's Opportunity College (SOC). SOC provides opportunities for active duty servicemen and women to pursue educational program goals through courses offered on base. In support of the concept, George Washington University, while still maintaining its academic standards, assumes the responsibilities of meeting the educational needs of an individual serving in the Armed Forces. Individuals who apply for admission as candidates for either Associate's or Bachelor's degrees from George Washington University's Columbian College of Arts and Sciences may, at their request, be designated as SOC students. Such students will be assured of a degree completion program through use of the agreement that follows.

AGREEMENT

George Washington University, a Servicemember's Opportunity College, agrees to the following:

I. Upon admission to Associate in Arts in General Studies or Bachelor of General Studies degree candidacy, the student may take the required course work either on or off campus. Regardless of where taken, courses of study taken while a degree candidate may be applied toward the degree sought, as a requirement or an approved elective. Although the grade of *D* is not acceptable for transfer, it may be used to satisfy a curriculum requirement. It may not, however, be counted toward the total number of semester hours required for the degree, and it should not be repeated. Courses will be taken from George Washington University unless the servicemember is transferred to a location not served by this University. In the case of transfer and in consideration of the student's future assignment, arrangements will be made between the student and the counselor assigned by the Division of Continuing Education and Summer Sessions to ensure that the courses taken elsewhere satisfy the George Washington University program.

II. Academic credit may be obtained by any one or a combination of the following:

A. Registration as an on- or off-campus, full- or part-time student at this University.

B. Advanced standing for academic studies taken at other accredited institutions when such studies meet the requirements for the degree, or by examination.

Within the maximum of 42 hours of credit allowed for advanced standing toward the Associate in Arts in General Studies degree, a maximum of 30 hours may be obtained by any one or combination of the methods

below. Within the maximum of 90 hours of credit allowed for advanced standing toward the Bachelor of General Studies degree, a maximum of 60 hours may be obtained by any one or combination of the methods below.

1. *College-Level Examination Program (CLEP) Subject Examinations*—see page 22. Maximum credit allowed for Associate's degree is 30 semester hours; maximum allowed for Bachelor's degree is 60 semester hours.

2. *College-Level Examination Program (CLEP) General Examinations*—see page 22. Maximum credit allowed is 18 semester hours.

3. *Columbian College of Arts and Sciences Special Departmental Examinations*—see page 75. Maximum credit allowed for Associate's degree is 30 semester hours; maximum allowed for Bachelor's degree is 60 semester hours.

4. *Service Schools*—A maximum of 30 (or a maximum of 12 if the courses are "professional") semester hours may be obtained on the basis of service schools satisfactorily completed, as evaluated in accordance with the "Guide to the Evaluation of Educational Experience in the Armed Forces," issued by the Committee on Accreditation of Service Experience. Ordinarily such subjects are counted as electives. No credit will be allowed for military experience as such.

5. *Correspondence Courses*—A maximum of 15 semester hours may be earned through the successful completion of correspondence courses of college level which are offered by the U.S. Armed Forces Institute or a regionally accredited college or university.

III. The minimum requirement for the Associate in Arts in General Studies degree is 60 semester hours; the minimum requirement for the Bachelor of General Studies degree is 120 semster hours. A minimum of 18 semester hours for the Associate's degree and a minimum of 30 hours for the Bachelor's degree must be completed at George Washington University, but may be completed at any point in the student's program of study. At least 6 semester hours in the selected area of concentration must be taken at this University.

IV. The Division of Continuing Education and Summer Sessions will handle and coordinate administrative matters and be the point of contact with the college granting the degree. The provisions as stated in the Division of Continuing Education and Summer Sessions *Off-Campus Schedule of Classes* will apply in all cases not specifically mentioned in this agreement.

V. Tuition and fees will be as stipulated in the Division of Continuing Education and Summer Sessions *Off-Campus Schedule of Classes* on a year-to-year basis.

VI. Students accepted under this program are subject to the probation and suspension regulations of the University, and are required to maintain scholastic standards.

VII. In addition to trained counselors, University representatives are assigned to each installation to assist in the counseling function.

Accelerated Programs

Courses leading to the Associate in Arts in General Studies and Bachelor

of General Studies degrees are offered in special accelerated programs at certain off-campus locations.

The basic framework for these programs includes an individual class schedule—two and a half hours a night, two nights a week (upper division courses are scheduled back-to-back to save travel). The length of term per class is eight weeks. The average time needed to complete the degree is 18 to 20 months for the Associate's degree and 35 to 40 months for the Bachelor's degree. For further information, contact the Division's Office of Student Services.

OTHER DIVISION PROGRAMS

The Division of Continuing Education and Summer Sessions administers the activities of the Center for Continuing Education in Washington, the English for International Students Program, and the Office of University and Summer Students.

CENTER FOR CONTINUING EDUCATION IN WASHINGTON (CCEW)

The Center provides a broad spectrum of services focusing on innovative, nontraditional, career-oriented education. Among CCEW programs are graduate-level career certificate programs (training legal assistants, publication specialists, landscape architect assistants, fund raising administrators, administrative managers, professional consultants, information systems specialists, and Washington representatives); the certified employee benefit specialist program; credit courses; test review courses (for CLEP, LSAT, GMAT, and GRE); and professional development seminars and workshops focusing on areas such as communication, management development, and personnel management.

The Center is the site of the University's Continuing Education for Women program, which has provided counseling and educational services to women in transition since 1964. More than 16,000 participants have benefited from the Continuing Education for Women programs, which currently include group and individual counseling, a series of special-interest courses focusing on issues confronting women, and three undergraduate certificate programs, which combine academic credit courses with skill-development seminars for supervisory specialists, communication specialists, and social services specialists.

ENGLISH FOR INTERNATIONAL STUDENTS

This is a comprehensive program in English as a foreign language designed to serve members of Washington's international community who wish to improve their command of English through an intensive or semi-intensive study program. Courses offered at various levels of proficiency, covering both oral and written communication, are scheduled in 14-week sessions during the fall and spring semesters and in two 10-week sessions during the summer. Students entering the program take a battery of tests to determine their levels of proficiency for placement in English and academic programs. Registration for the tests is held in advance of course registration at the Office of English for International Students, Park Lane Building, Room 120, 2025 Eye St., N.W., Washington, D.C.

20052. A $10 testing fee is charged each student. Persons writing from outside the United States and needing a student visa will be considered for an I-20 certificate of eligibility for student visa validation. Those interested in applying for a degree program should see the section entitled "Students from Foreign Institutions" for additional information.

OFFICE OF UNIVERSITY AND SUMMER STUDENTS

The Office of University and Summer Students (OUSS) makes on-campus credit courses available to those who are not currently degree candidates at this University. Such students, often employed in government or industry, may be taking courses to enhance their career potential or as a matter of personal interest. They may be candidates for higher degrees in other institutions, sent here for special work as part of a graduate program. They may be undergraduates matriculated elsewhere, taking courses for transfer to their own institution.

All courses except those restricted to medical and law students and those in the Departments of Accounting, Business Administration, and Management Science are open to nondegree students, provided they have sufficient preparation as determined by the academic departments. Students wishing to take engineering and applied science courses should consult the School of Engineering and Applied Science *Bulletin*.

Registration in a given course may be denied OUSS students when space is needed for degree candidates. OUSS students are not eligible to register for thesis or dissertation research. OUSS requires a minimum registration of three semester hours per semester or session, except in special circumstances.

Entrance Requirements*

An academic background appropriate for the program of studies contemplated is required. In addition, the applicant who has previously attended this or another college or university must be in good standing at that institution. An applicant who has been suspended from any educational institution for poor scholarship will not be considered for admission for one calendar year after the effective date of the suspension. An applicant who has been denied admission elsewhere within this University may be considered for admission through OUSS upon recommendation of the appropriate department and school or college.

Applications for admission through OUSS for a fall or spring semester must be received no later than the Friday before the first day of registration (see the Calendar, pages 5-7). Applications for admission for the summer should be submitted at least two working days prior to registration day. In both cases, however, applicants are urged to apply earlier. There is no application fee.

Regulations

Regulations concerning admission, registration, fees and finances are stated on pages 19-32; other University regulations, on pages 44-52.

* For admission requirements for students from foreign institutions, see pages 25-26.

Prospective and registered students are urged to acquaint themselves with the regulations concerning attendance (see page 44) and withdrawal (see page 47).

The following specifically apply to all students registered through OUSS:

Last day to add a class for credit—end of second week of classes.

Last day to drop a class for credit or to withdraw from the University—end of the seventh week of classes.

Equivalent amounts of time apply to the summer sessions.

ACADEMIC WORK LOAD

The normal academic work load during the regular academic year is not more than 10 semester hours for a student employed more than 20 hours per week and not more than 18 semester hours for a full-time student. During the summer a student may take a maximum of two courses during any one session. Exceptions to these limits must be approved by the dean.

SCHOLARSHIP REQUIREMENTS

A student who fails to maintain the scholarship requirements of OUSS may be dismissed from the University. A statement of scholarship requirements is available in the office of the dean.

All grades received in OUSS remain on the record; scholarship requirements are based on the total record.

Grades—See page 45. There is no limitation on the number of courses that may be taken on a pass/no pass basis in OUSS; however there may be a limit on the number that can be transferred to fulfill degree requirements.

INCOMPLETE/AUTHORIZED WITHDRAWAL

Conditions under which the grades of *I* (Incomplete) and *W* (Authorized Withdrawal) may be assigned are described on page 45.

Removing an Incomplete—The instructor normally sets a period (maximum of one year) within which the uncompleted work must be made up. An Incomplete which is not removed within one calendar year remains as a grade of *I* on the student's record.

CHANGE IN PROGRAM OF STUDIES

Change within the Office of University and Summer Students—A student may not change or drop courses (see "Withdrawal," page 47) or change status to that of auditor except with the approval of the dean.

Transfer within the University—Transfer to or from OUSS may be made only with the approval of the deans concerned.

Application for transfer to degree candidacy will be considered only after the completion of at least one semester in OUSS or upon request from the college or school to which the student is seeking admission.

Students wishing to transfer to degree candidacy must meet the conditions of the college or school to which they are applying. It is the responsibility of the student to consult the relevant degree-granting college or school concerning all conditions to be met and the amount of work transferable.

THE SUMMER SESSIONS

During the summer, Columbian College of Arts and Sciences, the Graduate School of Arts and Sciences, the School of Government and Business Administration, the School of Public and International Affairs, the School of Engineering and Applied Science, and the School of Medicine and Health Sciences offer courses in one three-week session and two five-week sessions. The National Law Center offers courses in two six-week sessions and one 3-week session; the School of Education and Human Development offers courses in three- and six-week sessions. The University also offers special programs during the summer which are not available during the regular academic year. Courses are offered during both day and evening hours.

Students who are enrolled at the University for the spring semester may register for the following Summer Sessions without special application. All others must apply for admission or readmission. No application fee is charged nondegree students. Those who wish degree status may seek admission from the appropriate college or school within the University. Those who do not wish to work toward a degree at the University may apply through the Office of University and Summer Students, and are subject to its entrance requirements and regulations stated above.

For a complete statement concerning summer term work, see the *Summer Sessions Schedule of Classes*.

COLLEGE PROGRAM FOR SECONDARY SCHOOL STUDENTS

The George Washington University College Program for Secondary School Students provides the promising high-school student an opportunity to take fully accredited college courses along with college students.

To take advantage of the University's unique location in the nation's capital, a diversified cultural and recreational program is arranged. Opportunities for observation, study, service, and recreation are limited only by the student's time, energy, and imagination.

A wide variety of the regular course offerings are available on a full-time basis during the Summer Sessions and on a part-time basis throughout the academic year to eligible students. During the summer program, students from outside of the Washington area must reside in an on-campus, University residence hall. Local residents may choose to stay in on-campus housing during the summer; however, housing is not available for part-time, commuting students who are taking college course work concurrently with their high school program during the fall and spring semesters.

Scholarships—For the summer programs, students with outstanding academic records and excellent standardized test scores will be considered automatically for full-tuition scholarships. Tuition awards are also made available to superior students enrolled during the fall and spring semesters. Because the awards are based on academic merit rather than financial need, only the program application is required for consideration, though the Admissions Coordinator may request updated test scores and or high school transcripts. While the scholarship will cover tuition costs and the recreational program in the summer, students must pay for room and board, incidental fees, and personal expenses.

For further information and an application, please write the College Program for Secondary School Students, Office of Admissions, George Washington University, Washington, D.C. 20052.

NONCREDIT COURSES AND PROGRAMS

In addition to the noncredit offerings of the Center for Continuing Education in Washington, the University also sponsors the noncredit continuing education activities of the School of Government and Business Administration, the School of Engineering and Applied Science (through its Continuing Engineering Education Program), and the School of Education and Human Development (through its Center for Research and Services).

DIVISION OF EXPERIMENTAL PROGRAMS

Director R.S. French
Assistant Directors L.J. Lear, L.P. Love

The University is committed to the continuous development of new curricular options for its faculty and students. The Division of Experimental Programs has as its function the support of such curricular experimentation and development. This University-wide curricular development program has three objectives: (1) cooperation among the academic divisions of the University in the development and sponsorship of new courses and programs; (2) experimentation with new ways of teaching and learning; and (3) a more direct relationship between campus and off-campus resources and interests. In pursuit of these objectives the Division awards faculty fellowships for interdisciplinary research, sponsors student-faculty societies for interdisciplinary education, and regularly organizes regional conferences on educational issues.

The Division administers the Center for Washington Area Studies, which coordinates Washington-related research and teaching conducted by numerous academic departments and programs throughout the University. Through the Center the Division supports an annual conference on local history, publishes a monograph series (*GW Washington Studies*), and sponsors each academic year the Banneker Visiting Professor of Washington Studies.

Under the auspices of the Division of Experimental Programs, students, faculty, and administrators throughout the University are involved in the planning, teaching, and evaluating of experimental courses and degree programs. Many curricular experiments which receive financial support through the Division of Experimental Programs are sponsored by other academic units of the University, e.g., the 700 Series of Courses in General and Interdisciplinary Studies. There are presently two academic programs directly sponsored by the Division—the Program in Experimental Humanities and the Service-Learning Program.

The Program in Experimental Humanities offers courses which provide opportunities for students to combine sustained field study with classroom work. These courses are sometimes taught by interdisciplinary and interdivisional faculty teams. Some Experimental Humanities courses are residential courses in which students enrolled in the same class also live together in designated areas of university housing.

The Service-Learning Program integrates off-campus, preprofessional work placements with classroom seminars. Students in the program are placed in community groups, research organizations, or governmental agencies. Assignments are arranged by means of a formal agreement among the student, the program, and the off-campus placement. Instructors in the seminars are members of the faculty in one of the professional schools of the University.

The Division of Experimental Programs is charged with mobilizing academic resources throughout the University that can appropriately address needs in the Washington metropolitan community. Among the activities of the Division is a community assistance program in the Anacostia area. Selected students receive stipends for services to residents and work with community organizations.

ASSOCIATES

William H. Becker, *Faculty Associate for Business Studies*
James Deakin, *Faculty Associate for Political Communications Studies*
Thelma Z. Lavine, *Faculty Associate for Interdisciplinary Studies*
Gail J. Povar, *Faculty Associate for Humanities and Medicine*
Colin M. Turnbull, *Faculty Associate for Community Studies*

STEERING COMMITTEE

Harold Frederick Bright, *Provost and Vice President for Academic Affairs, Chairman*
Lawrence Thompson Bowles, *Dean of the Medical Center, for Academic Affairs*
Marcella Brenner, *Professor of Education*
Carl James Lange, *Professor of Psychology; Vice President for Administration and Research*
Norma Maine Loeser, *Professor of Business Administration; Dean of the School of Government and Business Administration*
John Mortimer Logsdon, *Professor of Public Affairs and Political Science*
Ralph Clarke Nash, *Professor of Law*
Judith Ann Abrams Plotz, *Associate Professor of English*
Henry Solomon, *Professor of Economics; Dean of the Graduate School of Arts and Sciences*

POLICY STUDIES AND SPECIAL PROJECTS

Vice President for Policy Studies and Special Projects L.H. Mayo

The Vice President for Policy Studies and Special Projects is responsible to the President of the University for developing an interdisciplinary capability for analyzing national policy issues. There is involvement with the Consortium universities and with foundations, federal agencies, industry, and other organizations which interact with the governmental process.

The office serves the University as a locus for discussion and as an advisory resource on interdepartmental and interdisciplinary research related to the analysis of public policies, and on curricula pertaining to broad social or environmental problems.

The University has sustained an institutional commitment, in terms of faculty recruitment and program emphasis, to issue-oriented policy analysis as a major focus of teaching and research activities. The result of thirteen years of development is a significant, institutional capability for comprehensive analysis of complex policy issues. Major programs oriented to public policy and governmental functions, which come within the ambit of this office, are described below.

PROGRAM OF POLICY STUDIES IN SCIENCE AND TECHNOLOGY

Director L.H. Mayo
Executive Associate Pamela B. Smith

The Program's primary objective is the continuing development of a University-wide policy research capability related to problems stemming from the impact of technological change on the processes, values, and institutions of society. The Program provides a neutral forum for consideration of these policy issues—whether in a retrospective, current, or prospective context—and provides an advisory and research resource for policy makers in the public and private sectors.

The Program's primary components are:

1. *The Technology Assessment Group*—The Program has been closely involved with the evolution of the concept of Technology Assessment (TA), which has become federally institutionalized in the Congressional Office of Technology Assessment. Much of the early work of the Program consisted of theoretical, methodological, institutional, and historical studies. Since 1973, however, the TA Group has carried out studies in a variety of subject areas including transportation, energy, community development, environmental noise, communications, and governmental structure and process, under contracts or grants from most of the major federal agencies.

2. *The Graduate Program in Science, Technology, and Public Policy*—This Master's degree program—co-sponsored by the Program of Policy Studies and the School of Public and International Affairs (SPIA)—combines graduate training in science policy analysis with major research undertakings. The program is the largest degree-granting science policy pro-

gram in the United States. Admissions information is contained in the SPIA section of this *Bulletin*.

3. *The Behavioral Studies Group*—This part of the Program focuses on the social and behavioral factors associated with technological development. It is a multidisciplinary group, with expertise in motivational and behavioral aspects of technology assessment in the areas of transportation, energy use, communication, energy conservation, new town program development, public health (family planning, community mental health), and education. Work includes applications of TA to program development and evaluation, as well as to dissemination and utilization of strategies to improve the constructive uses of technologies in these areas.

The Program of Policy Studies normally has between 10 and 15 professionals and many students working on several projects, most of which are problem-oriented and interdisciplinary in nature. Members of the faculty, graduate students, members of governmental agencies, and special consultants are regularly involved in our studies. To date the Program has performed over 75 policy studies and has published over 150 reports, monographs, books, and special papers which have been distributed to professionals and institutions throughout the world. Funding for the Program's activities has come from a variety of sources: the University; federal agencies, including DOE, EPA, HHS, HUD, NASA, Commerce, OTA, and NSF; and private foundations, including The Ford Foundation.

Professional Associates

Director Louis H. Mayo, *Vice President for Policy Studies and Special Projects; Professor of Law*
Daniel P. Beard, *Research Scientist (Natural Resources Policy)*
James M. Brown, *Senior Staff Scientist; Professor of Law*
Craig A. Decker, Jr., *Consultant (Appropriate Technology)*
Lynne D. Filderman, *Research Associate (Policy Analysis)*
Charles V. Kidd, *Senior Staff Scientist (Public Affairs)*
Samuel Robert Lichter, *Assistant Professor of Political Science*
John M. Logsdon, *Research Scientist; Director, Graduate Program in Science, Technology, and Public Policy; Professor of Public Affairs and Political Science*
Joseph B. Margolin, *Senior Staff Scientist; Director, Behavioral Studies Group*
Joseph Mintzes, *Consultant (International Affairs)*
Marion R. Misch, *Research Scientist; Deputy Director, Behavioral Studies Group*
Henry R. Nau, *Graduate Program in Science, Technology, and Public Policy; Associate Professor of Political Science and International Affairs*
Herman Pollack, *Research Professor of International Affairs (Political Science)*
Robert W. Rycroft, *Deputy Director, Graduate Program in Science, Technology, and Public Policy; Assistant Professor of Public Affairs and Political Science*
Anne C. Webb, *Research Associate (Policy Analysis and International Affairs)*
Burke K. Zimmerman, *Associate Research Professor of Public Affairs*

NATIONAL HEALTH POLICY FORUM

Director Judith Miller Jones
Associate Director Marion Ein

The National Health Policy Forum assists professional staff members employed by the executive and legislative branches of the federal government to gain a better understanding of health delivery practices and related current public policy issues. Its purpose, also, is to facilitate communication between Washington health policy makers and experts in the field who represent the academic community, labor, industry, the health professions, and consumer groups. Exposure to problems and issues facing the entire country is gained primarily through sequenced evening discussions or workshops and, where appropriate, site visits. Although attendance is primarily limited to Congressional aides and top-level health staff from the many government agencies involved in health, George Washington University students and faculty can be accommodated on a space-available basis.

SPONSORED RESEARCH

Vice President for Administration and Research C.J. Lange

These special programs were established for the specific purpose of considering, in an academic atmosphere, problems proposed by the individual projects or submitted by the sponsoring agency. Cooperation between these programs and the various departments of instruction is as close as the nature and needs of the programs and departments will permit.

CENTER FOR SOCIAL POLICY STUDIES

Director Sar Levitan

The Center for Social Policy Studies is devoted to the evaluation of federally-supported manpower, antipoverty and related programs. The Center is financed by a grant from the Ford Foundation and offers, in conjunction with the Department of Economics, graduate courses in labor economics and social policy.

EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC) CLEARINGHOUSE ON HIGHER EDUCATION

Director Jonathan Fife

The Educational Resources Information Center (ERIC) Clearinghouse on Higher Education, established in the fall of 1968, is supported by the National Institute of Education. The Clearinghouse is responsible for the acquisition, evaluation, abstracting, indexing and dissemination of research reports and other documents dealing with problems and issues in higher

education, prepares state-of-the-art and review papers related to higher education and responds to individual inquires concerned with higher education.

INSTITUTE FOR MANAGEMENT SCIENCE AND ENGINEERING

Director W.H. Marlow

The Institute for Management Science and Engineering provides a multidisciplinary environment for innovative graduate teaching and substantial opportunities for research activities and public service under diversified sources of external support. Through its Program in Logistics, the Institute performs research leading to the development of a science in logistics featuring principles and methodology for resource allocation problems in civil affairs and national defense efforts.

MID-ATLANTIC REGIONAL RESOURCE CENTER

Director Raymond Cottrell
Associate Director Nona Flynn
Assistant Director Linda Foley

The Mid-Atlantic Regional Resource Center is one of a number of centers serving under contract to the Office of Special Education, Department of Education. The area served includes Delaware, District of Columbia, Maryland, Pennsylvania, Virginia, and West Virginia. The primary mission of the project is to assist state education agencies and affiliated agencies within its area to comply with the requirements of PL-142.

NATURAL RESOURCES POLICY CENTER

Director Mary Holman

The Natural Resources Policy Center was established in September, 1965, to sponsor faculty and student research in the area of natural resources and environmental quality; to develop and undertake activities that promote undergraduate and graduate education; and to train employees of public resource agencies. The program of the Center focuses particularly on increasing the contribution of the social sciences to the solution of contemporary problems relating to the management and development of natural resources. The Natural Resources Policy Center, which provides a focus on natural resource and environmental quality problems and issues, is an integral part of the Department of Economics in both the design of its research program and its courses.

SOCIAL RESEARCH GROUP

Director Ira Cisin
Associate Director Philip W. Wirtz

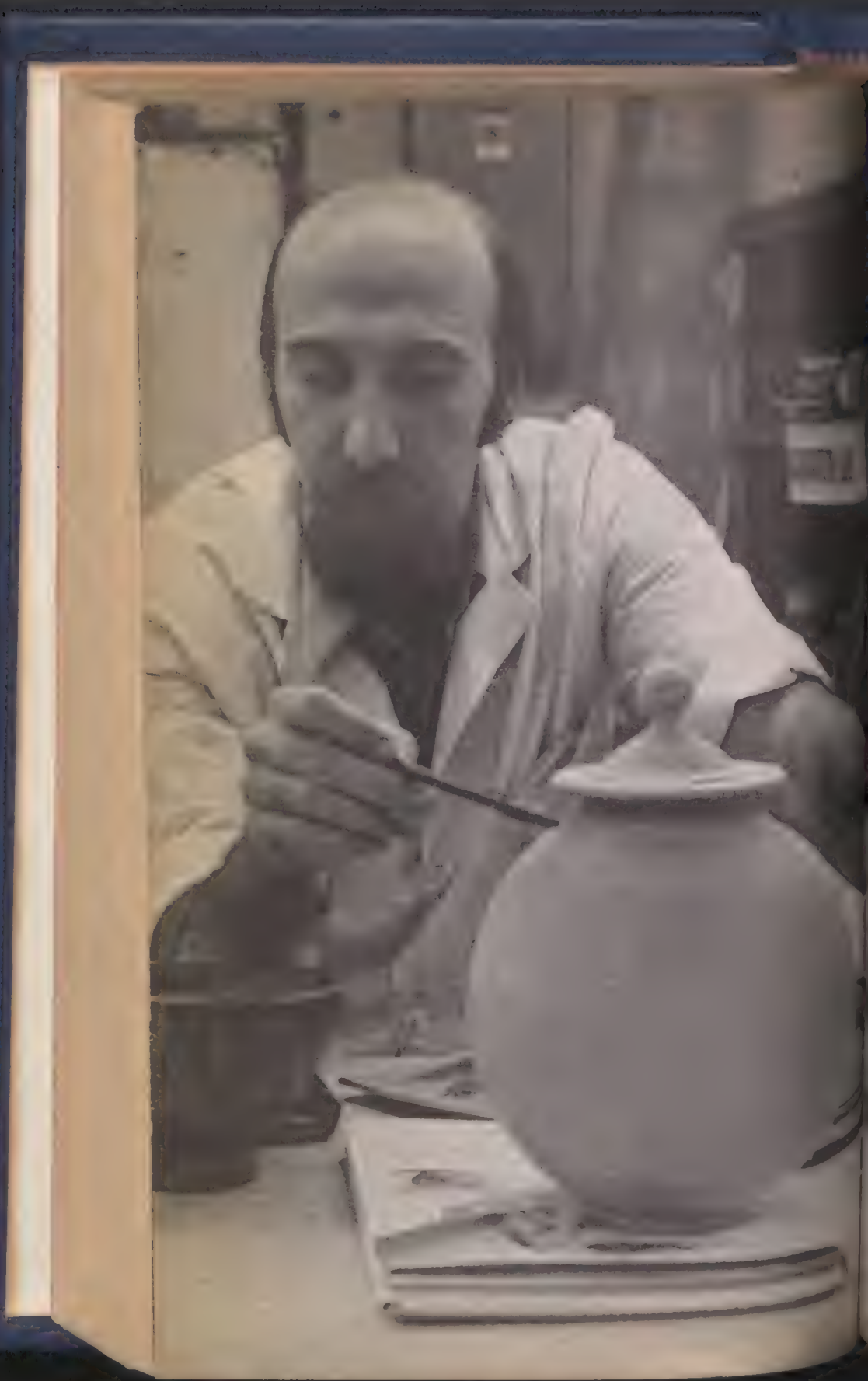
The Social Research Group conducts surveys and experiments with concentration on basic research underlying an approach to the solution of social problems.






THE
GEORGE WASHINGTON
UNIVERSITY

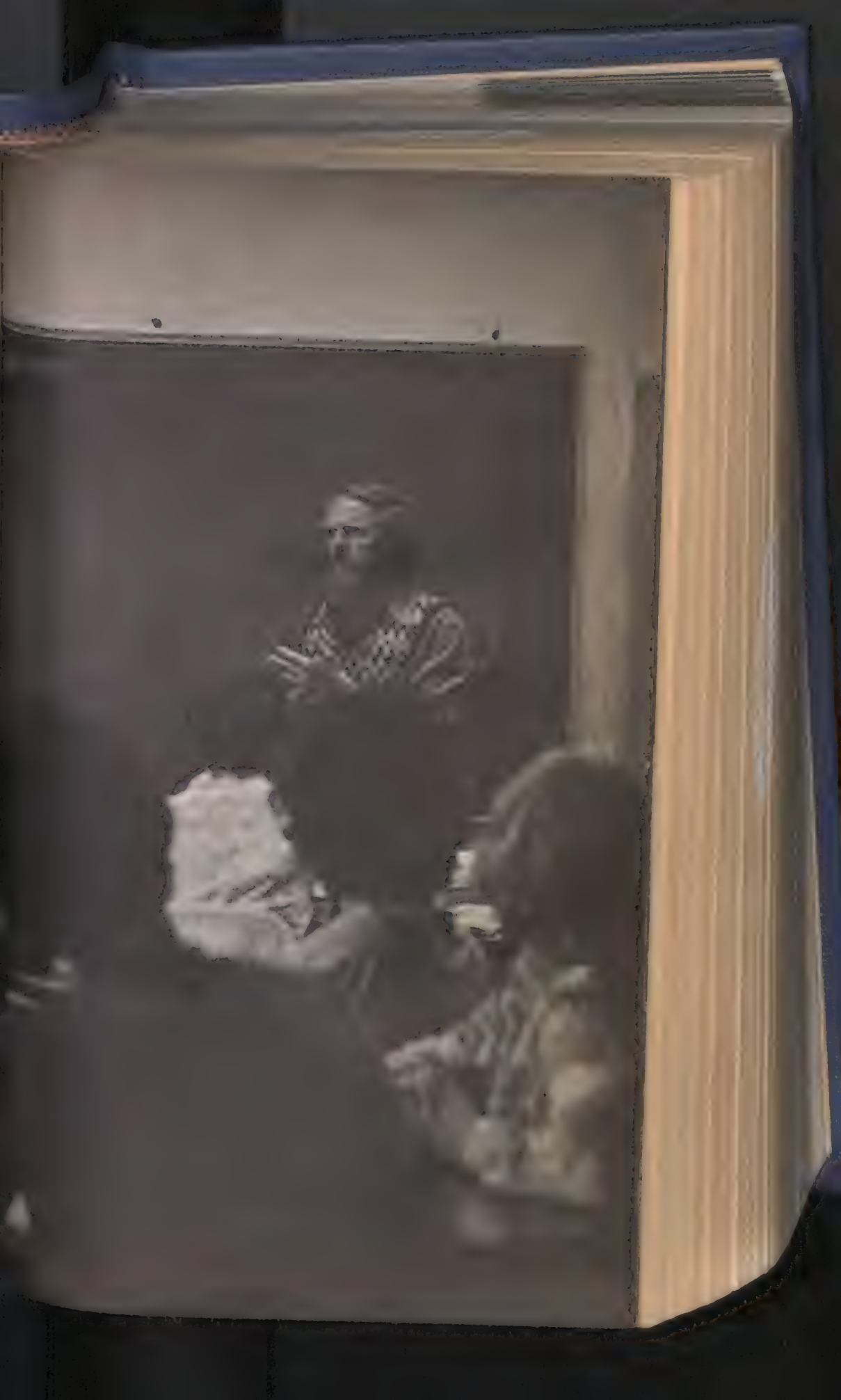






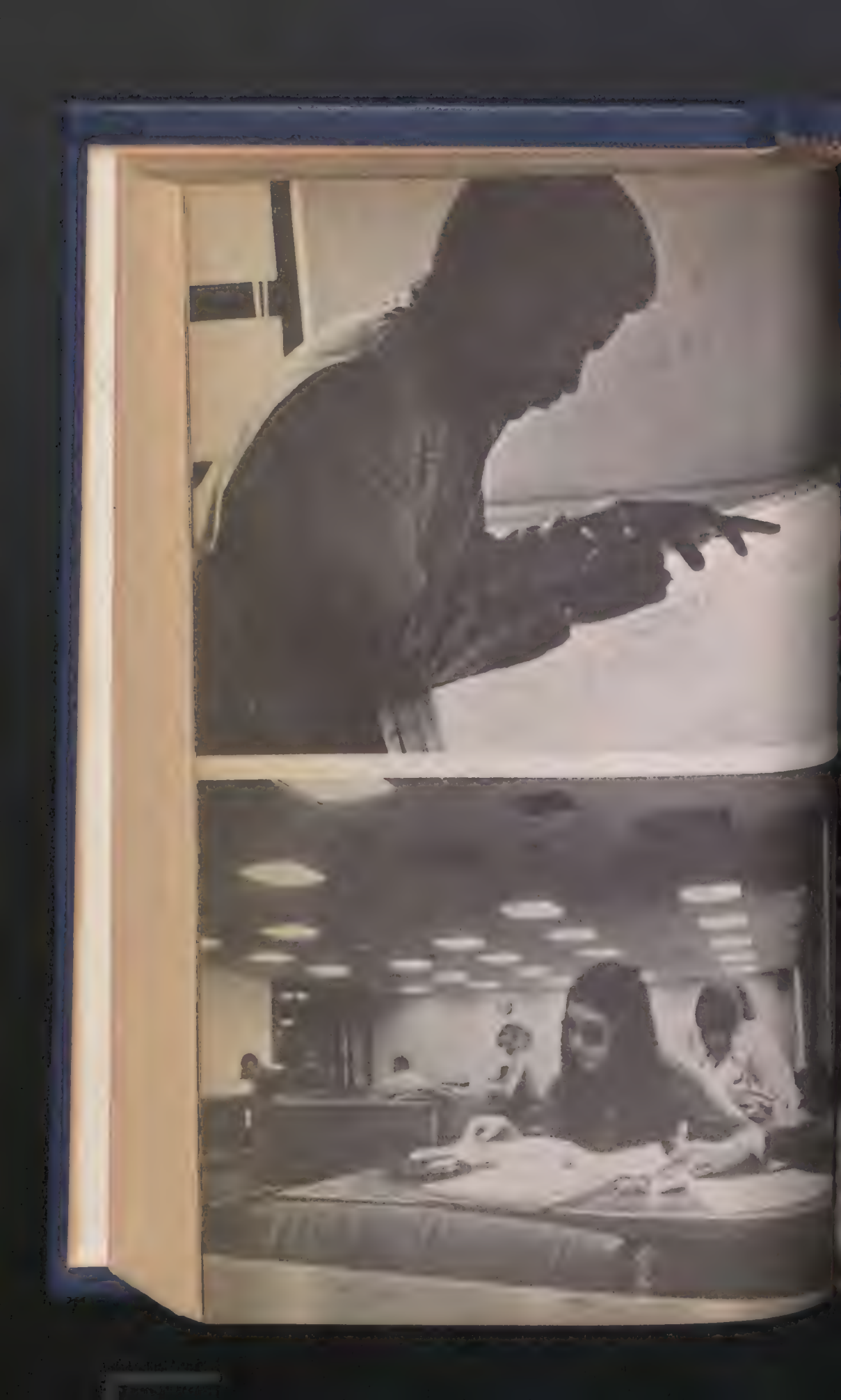










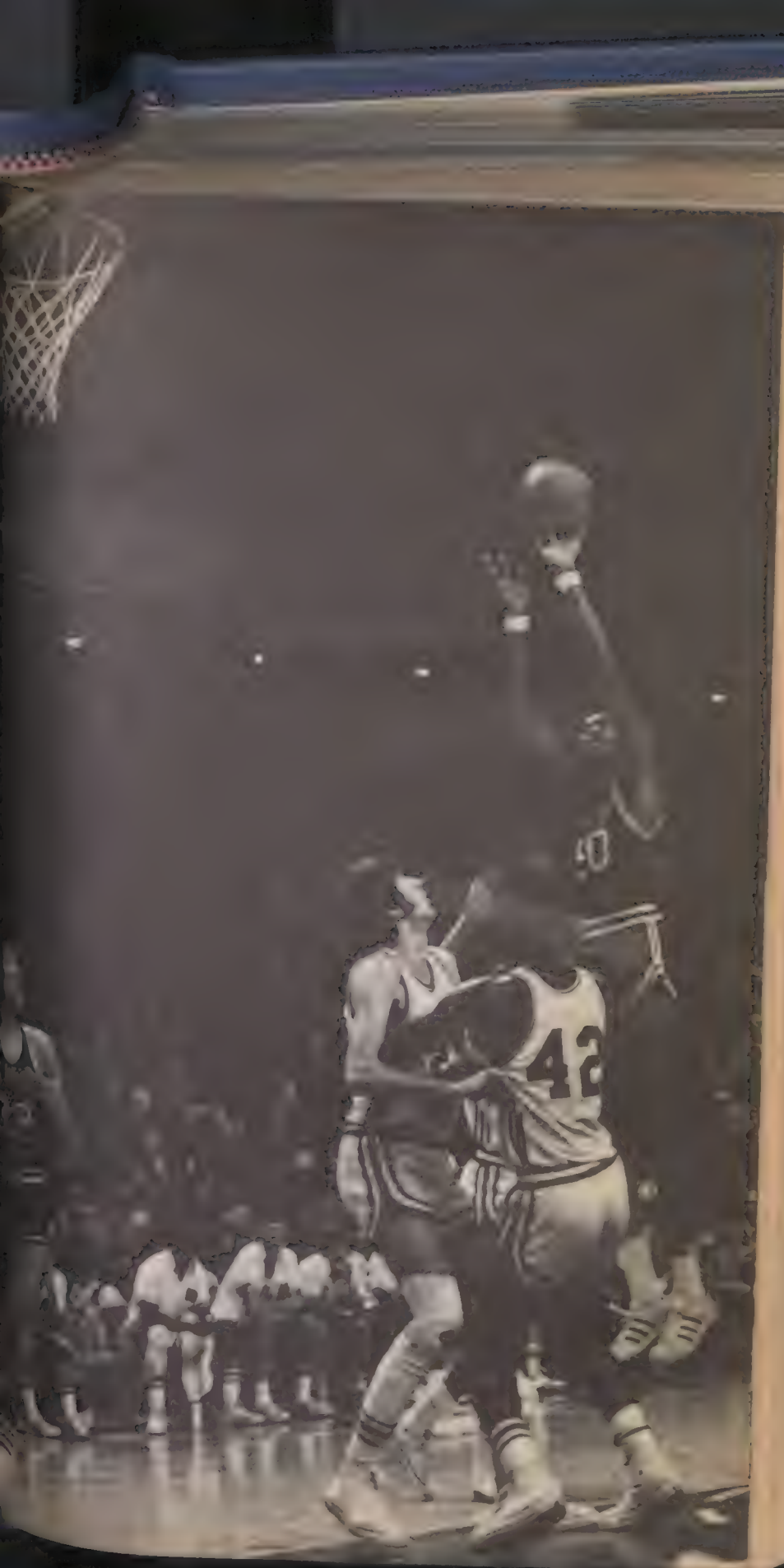


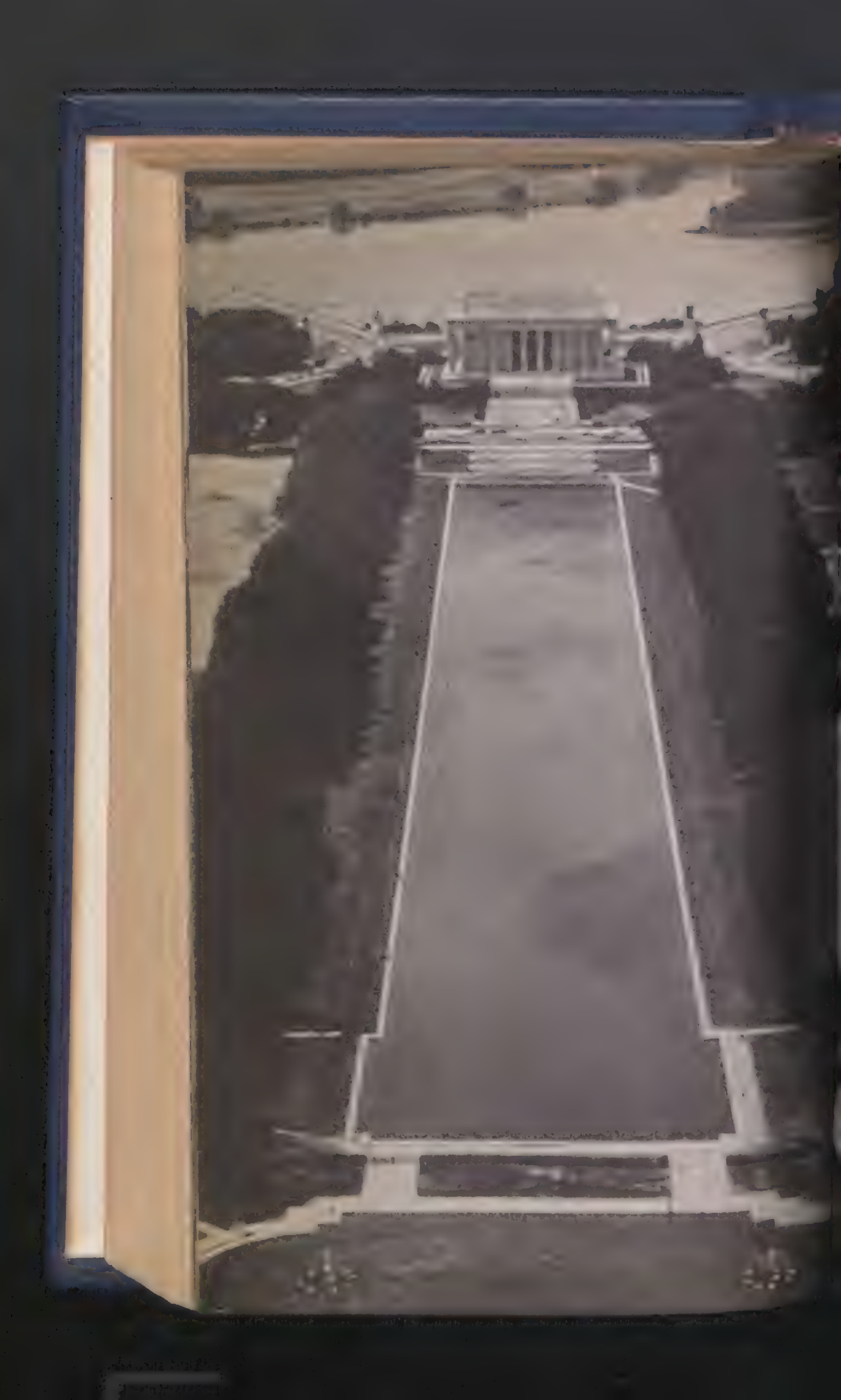







CHARLES E. SMITH









COURSES OF INSTRUCTION

The following pages contain listings and descriptions of courses offered by the departments of instruction and special interdepartmental programs. The courses as here listed are subject to change. The University reserves the right to withdraw any course announced or to change the course fees shown herein.

HOURS OF INSTRUCTION

Classes are scheduled in the morning, afternoon, and evening. Evening and daytime sections of the same course are identical, are taught by the same staff of instructors and carry the same amount of credit.

EXPLANATION OF COURSE NUMBERS

First-group courses—Courses numbered from 1 to 100 are planned for students in the freshman and sophomore years. With the approval of the advisor and the dean, they may also be taken by juniors and seniors. In certain instances, they may be taken by graduate students to make up undergraduate deficiencies or as prerequisites to advanced courses, but they may not be taken for graduate credit.

Second-group courses—Courses numbered from 101 to 200 are planned for students in the junior and senior years. Except for accounting courses, they may be taken for graduate credit only upon the approval of the Dean and the instructor at the time of registration. Such approval is granted only with the provision that students must complete additional work to receive graduate credit. Accounting courses numbered 101-200 may not be taken for graduate credit.

Third-group courses—Courses numbered from 201 to 300 in the Graduate School of Arts and Sciences and the School of Government and Business Administration, and courses numbered 201 to 400 in the School of Education and Human Development, are planned primarily for graduate students. They are open, with the approval of the instructor, to qualified seniors; they are not open to other undergraduates. Qualified seniors in the School of Government and Business Administration registering for these courses must have a 3.00 average, the prior approval of the department chairman who is responsible for the graduate course, and the prior approval of the dean. Non-degree students who have not completed a bachelor's degree may not enroll in graduate courses offered by the School of Government and Business Administration.

Fourth-group courses—Courses numbered 301 to 400 in the Graduate School of Arts and Sciences are limited to graduate students, but they are primarily for doctoral candidates. Courses numbered 301 to 400 in the School of Government and Business Administration are limited to doctoral students. In the School of Education and Human Development fourth-group courses, numbered 401 to 500, are limited to graduate students with master's degrees from accredited institutions.

Fifth-group courses—Courses numbered 701 and 721 represent an ongoing program of curriculum innovation at GW. The 701 number is used to designate experimental courses taught by individual faculty members. The

721 number designates innovative interdepartmental courses. Courses numbered in the 770s are taught by scholars who hold appointments as University Professors. The 700 numbers do not indicate the level of difficulty. Courses in this series range from freshman-level offerings to classes designed for seniors and graduate students. Unless the course description in the *Schedule of Classes* indicates that there are prerequisites or that an interview with the instructor is required prior to registration, 700 courses are open to all interested students, subject to their advisor's approval and the rules of the respective colleges.

KEY TO ABBREVIATIONS

The following abbreviations are used for course designations:

Acct	Accounting
AmCv	American Civilization
Anat	Anatomy
Anes	Anesthesiology
Anth	Anthropology
ApSc	Applied Science
Art	Art
ArTh	Art Therapy
Bioc	Biochemistry
BlSc	Biological Sciences
BAd	Business Administration
Cart	Cartography
Chem	Chemistry
ChAD	Child Health and Development
Chin	Chinese
CE	Civil Engineering
Clas	Classics
ClEn	Clinical Engineering
CSci	Computer Science
Derm	Dermatology
Econ	Economics
Educ	Education
EPol	Education Policy
EE	Electrical Engineering
EAd	Engineering Administration
EngS	Engineering Science
Engl	English
EFL	English as a Foreign Language
EnHe	Environmental Health
Envr	Environmental Studies
Hum	Experimental Humanities
ForS	Forensic Sciences
Fren	French
Gnet	Genetics
Geob	Geobiology
Geod	Geodesy
Geog	Geography and Regional Science
Geol	Geology
Ger	Germanic Languages and Literatures
Gern	Gerontology
HCS	Health Care Sciences
HSA	Health Services Administration
Hist	History
HKLS	Human Kinetics and Leisure Studies
Idis	Interdisciplinary Courses
IAf	International Affairs
Japn	Italian
Ital	Japanese
Jour	Journalism
Law	Law
Libr	Library
Mgt	Management Science
Math	Mathematics
ME	Mechanical Engineering
MaPA	Medical and Public Affairs
Med	Medicine
Micr	Microbiology
MStd	Museum Studies
Mus	Music
NSur	Neurological Surgery
Neur	Neurology
ObsG	Obstetrics and Gynecology
Ocea	Oceanography
OR	Operations Research
Opht	Ophthalmology
Oral	Oral Biology
Orth	Orthopaedic Surgery
Otol	Otolaryngology
Path	Pathology
Phar	Pharmacology
Phil	Philosophy
Phys	Physics
Phyl	Physiology
PCm	Political Communications
PSc	Political Science
Port	Portuguese
Pchi	Psychiatry and Behavioral Sciences
Psyc	Psychology
PAd	Public Administration
RSci	Radiological Sciences

Rad	Radiology
RPol	Regulatory Policy
Rel	Religion
SLP	Service Learning Program
Slav	Slavic Languages and Literatures
Soc	Sociology
Span	Spanish
SpEd	Special Education
SpDr	Speech and Drama
Stat	Statistics
Surg	Surgery
TCom	Telecommunication Operations
Univ	University
UARP	Urban and Regional Planning
Urol	Urology
WStu	Women's Studies

SEMESTER HOURS OF CREDIT

The number of semester hours of credit given for the satisfactory completion of a course is, in most cases, indicated in parentheses after the title of the course. Thus, a year course giving three semester hours of credit each semester is marked (3–3), and a semester course giving three semester hours of credit is marked (3). A semester hour may be defined as one 50-minute period of class work or one laboratory period a week for one semester.

TIME OF COURSE OFFERINGS

Following most course descriptions is a parenthetical statement listing the semester (fall or spring) for which the course is scheduled. The term "academic year" is used only with two-semester courses, and indicates that the first half of the course is to be offered in the fall semester and the second half in the spring semester. Not all offerings for the summer sessions are listed in this *Bulletin*. Students should consult the *Summer Sessions Schedule of Classes* for additional summer offerings. A *Schedule of Classes* is published each fall and spring semester to provide information concerning the time of course offerings.

ACCOUNTING

Professors E.J.B. Lewis, A.J. Mastro *(Chairman)*, F.C. Kurtz, C.M. Paik, M.G. Gallagher, J. Hilmy
Professorial Lecturer F.W. Segel
Assistant Professors F.J. Rooney, D.R. Sheldon, B.E. Committe, G.C. Wooding
Assistant Professorial Lecturer P. Ben Ezra
Instructors D. Gray, J.A. Talbot, G.B. Wright, N. McDermott

Bachelor of Business Administration in the field of accounting—See pages 135–42.

Master of Accounting—Required: the general requirements, pages 145–48. All candidates are required to complete 30 semester hours of graduate course work. Acct 211, 221, 232, 251, 261, 263, 264, 275, 282, and Mgt 247. A maximum of 6 semester hours may be approved for transfer into the program. Specific prerequisite courses covering the common body of knowledge in business and accounting will vary, based on the student's status upon admission to the program.

Doctor of Business Administration and Doctor of Public Administration, see pages 159–60. Students admitted to the doctoral program with accounting as the major field may be considered for concurrent appointments as Instructors. Criteria for selection include a Master's degree and a C.P.A. Courses to be taught are restricted to Acct 51 and 52. See Chairman of the Accounting Department for details.

Accounting courses numbered below the 200 level may not be taken for graduate credit. Accounting courses numbered 200 and above may not be taken for undergraduate credit.

First Group

51–52 **Introductory Accounting** (3–3) Gallagher, Kurtz
Basic understanding of accounting concepts, procedures, analyses and reports; the accounting measurement and communications of significant economic and financial data. There is a $25 laboratory fee for Acct 51. Prerequisite: sophomore status. Acct 51 is prerequisite to Acct 52. Students who have received credit for a similar financial accounting course cannot receive credit for Acct 51. (Acct 51 and 52—fall and spring)

Second Group

101 **Cost and Budgetary Control** (3) Sheldon
Cost behavior and volume-profit relationships, responsibility accounting, standard costs, cost structures for control and decision making, relevant costs, cost concepts and variance analyses. Prerequisite: Acct 51–52 and junior status. Students who have received credit for Acct 193 cannot receive credit for Acct 101. (Fall and spring)

111 **Financial Statement Analysis** (3) Hilmy
Analysis and interpretation of financial statements for the guidance of management, directors, stockholders, and creditors. Prerequisite: Acct 51–52. (Fall and spring)

121 **Intermediate Accounting** (3) Hilmy, Wooding
In-depth study of accounting functions and basic theory; acquisition of assets and services, income and equity accounting, preparation and analysis of financial statements. Prerequisite: Acct 51–52 and junior status. Laboratory fee, $25. (Fall)

132 **Accounting Theory** (3) Segel, Wooding
Current thought as reflected in the pronouncements of leading professional and accounting research associations, major contributions to accounting literature. Prerequisite: Acct 121 and senior status. (Spring)

141 **Governmental Accounting** (3) Lewis
Appropriation, encumbrance, and fund accounting for governmental and institutional entities. Prerequisite: Acct 51–52. (Fall)

161 **Federal Income Taxation: Individuals** (3) Rooney
A study of federal income tax concepts with primary emphasis on individuals. Prerequisite: Acct 51–52 and junior status. (Fall and spring)

162 **Federal Income Taxation: Corporations, Partnerships, Estates, and Trusts** (3) Rooney
Federal income tax concepts applicable to corporations, partnerships, estates and trusts; tax research and planning. Prerequisite: Acct 161. (Spring)

171 **Auditing** (3) Committe, Kurtz
Principles and procedures of auditing: generally accepted auditing

standards, internal control, audit objectives and reports, audit evidence, professional and legal responsibility, and audit of E.D.P. systems. Prerequisite: Acct 121 and senior status. (Fall)

181 **Accounting Systems** (3) Wooding
Data processing considerations in the design and operation of accounting systems. Principles of internal control applicable to manual and automated accounting systems. Prerequisite: Acct 101, 171, and senior status. (Spring)

190 **Special Topics in Accounting** (3) Staff
Experimental offering; new course topics and teaching methods. Prerequisite: Department approval.

191 **Advanced Accounting** (3) Ben Ezra, Hilmy
Application of accounting theory to special areas: consolidated statements, business combinations, earnings per share, foreign exchange, price-level adjusted statements, source and application of funds. Prerequisite: Acct 121, and junior status. (Spring)

193 **Business Budgeting** (3) Lewis
Principles and procedures in the development, installation, and operation of a system of budgetary control to aid management. Prerequisite: Acct 51–52. Students who have received credit for Acct 101 cannot receive credit for Acct 193. (Fall and spring)

199 **Accounting Practice Internship** (3) Mastro
Concepts, procedures and standards of auditing practice obtained as an intern with a firm or agency. Prerequisite: 15 semester hours of accounting courses (including a course in auditing), senior status, and approval of the chairman of the department. (Spring)

Third Group

201 **Financial Accounting** (3) Kurtz
For designated students in the M.B.A. program. The role of accounting in the decision-making process of external parties; the understanding, interpretation, and implementation of financial accounting. (Course equivalent: a similar graduate financial accounting course, or Acct 51–52, or two similar undergraduate courses.) (Fall and spring)

211 **Business Law for Accountants** (3) Rooney
A study of the legal process and of the principles and precepts of business law; corporations, partnerships, property, trusts, wills, and the legal liability of the accountant. Prerequisite: Master of Accounting status. (Fall)

220 **Management Accounting** (3) Falk
The role of accounting in the decision-making processes of management; understanding of how accounting influences resource allocation decisions in the organization. Prerequisite: Acct 201. (Fall and spring)

221 **Cost Analysis** (3) Sheldon
An advanced cost accounting course with emphasis on comparative costs, quantitative techniques in cost analysis, and managerial accounting reporting systems. Prerequisite: Master of Accounting status. (Spring)

232 **Generally Accepted Accounting Standards** (3) Mastro
A critical understanding of the Financial Accounting Standards Board Pronouncements (Standards) and the Security and Exchange Commission—Accounting Series Releases. Prerequisite: Master of Accounting status. (Spring)

242 **Business Income Taxation** (3) Gallagher
(Formerly Acct 262)
Federal tax concepts applicable to individuals, partnerships, fiduciaries, and corporations; emphasis on recognition of tax consequences attached to common business transactions, and tax planning. Not open to M.Acct. candidates. (Fall and spring)

251 **Accounting for Multinational Corporations** (3) Segel
A study of international accounting standards with emphasis on accounting for foreign conversion requirements compatible with domestic accounting consolidation standards. Prerequisite: Acct 201 and 220. (Fall)

261 **Federal Income Taxation of Individuals** (3) Gallagher
A study of federal income taxation of individuals covering gross income, deductions and credits, sales, and other disposition of property, capital gains and losses, and timing. Prerequisite: Master of Accounting status or departmental approval. (Fall)

262 **Federal Income Taxation of Partnerships** (3) Rooney
(Formerly Business Income Taxation)
Federal income taxation of partnerships; formation, operation, distributions, and transfer of partnership interests. Prerequisite: Master of Accounting status or departmental approval, and Acct 261. (Spring)

263 **Federal Income Taxation of Corporations** (3) Gallagher
A study of federal income taxation of corporations, covering capital structure, distributions not in and in complete liquidation, and corporate accumulations. Prerequisite: Master of Accounting status or departmental approval, and Acct 261. (Spring)

264 **Federal Taxation of Estates, Gifts, and Trusts** (3) Gallagher
A study of estates, gifts, and trusts covering gross estates, state transfer taxes, valuation problems, planning estate liquidity, complex trusts. Prerequisite: Master of Accounting status or departmental approval, and Acct 261. (Spring)

275 **Contemporary Auditing Theory and Procedures** (3) Committe, Kurtz
Study of advanced independent (external) and internal auditing concepts: application of statistical sampling to auditing, audit of electronic data processing systems. Prerequisite: Master of Accounting status. (Spring)

276 **Management Planning and Control** (3) Paik
Integrative case study approach to management systems for planning, control, and decisions: value indices for organizational subunits, transfer pricing, contemporary control systems, accounting framework and cycle. Prerequisite: Acct 201 and 220. (Spring)

277 **Accounting and Decision Systems** (3) Paik
Accounting as a basis for economic decision-making by management and investors. Prerequisite: Acct 201 and 220. (Fall)

282 **Accounting Information Systems** (3) Wooding
Development and application of accounting system theory, including analysis, design, and implementation. Integration of automatic data processing, accounting systems, and management information systems. Prerequisite: Acct 201 and 220. (Fall)

290 **Special Topics in Accounting** (3) Staff
Experimental offering; new course topics and teaching methods. May be repeated once for credit. (Fall or spring)

298 **Directed Readings and Research in Accounting** (3) — Mastro and Staff

Fourth Group

Fourth-group courses are primarily for doctoral students, and are offered as the demand requires. The courses are open to other graduate students at the discretion of the department.

311–12 **Seminar: Public-Private Sector Institutions and Relationships** (3–3) — Staff

An analysis and critique of alternative theoretical frameworks for describing, understanding, and predicting the nature, values, and actions of American public and private institutions. Problems, potentials, and alternatives for structuring public and private institutional arrangements to meet the needs of society.

391 **Accounting Form and Substance—Doctoral Seminar** (arr.) — Mastro, Sheldon

Discourse on current and major accounting issues. Presentation of papers by doctoral candidates and accounting faculty. Monthly, from start to end of doctoral program in accounting. (Fall and spring)

398 **Advanced Reading and Research** (arr.) — Mastro and Staff

Limited to students preparing for the Doctor of Business Administration or Doctor of Public Administration general examination. May be repeated for credit. (Fall and spring)

399 **Dissertation Research** (arr.) — Mastro and Staff

Limited to Doctor of Business Administration or Doctor of Public Administration candidates. May be repeated for credit. (Fall and spring)

AMERICAN LITERATURE

See English.

AMERICAN STUDIES PROGRAM

Professors R.H. Walker, Jr., C.C. Mondale, B.M. Mergen *(Director)*
Professorial Lecturers L. Miller, D. Wigdor
Associate Professors J.O. Horton, H.F. Gillette, Jr., L.W. Banner *(Visiting)*, J.M. Vlach
Associate Professorial Lecturers C.R. Field, J.K. Zilczer
Assistant Professors P.M. Palmer, M.S. Shapiro
Adjunct Assistant Professor P.J. Cressey
Assistant Professorial Lecturer B.G. Carson

Affiliated Programs

David Wigdor (Library of Congress)
Atlee Schidler (Washington Center for Metropolitan Studies)
Wilcomb E. Washburn (Smithsonian Institution)

Faculty Advisory Committee

C.C. Mondale *(Chairman)*, S. Carroll, F.S. Grubar, R.L. Humphrey, J. Moreno, O. Seavey, R.P. Sharkey, R.W. Stephens, D.D. Wallace, Jr., A.M. Yezer

American Studies Council

The Council serves the American Studies Program in an advisory capacity.

It includes representatives from the student body, the Washington community, the faculty, alumni, and affiliated programs.

Bachelor of Arts with a major in American civilization (field-of-study)—The following requirements must be fulfilled:

1. The general requirements stated on pages 71–72, 79–85.

2. Prerequisite course—AmCv 71–72. (In preparation for the major field it is recommended that students take the introductory American history course and elect introductory courses in anthropology, art, economics, English, geography and regional science, philosophy, political science, religion, and sociology.)

3. Required courses in the major—(a) 15 semester hours of approved second-group courses in an American civilization core field, including U.S. social history (6 hours), American literature (6 hours), and an interdisciplinary elective (3 hours); (b) 15 semester hours of approved second-group courses in a related discipline or topical area; (c) AmCv 179–80, which must be taken in the senior year.

The major examination required of all seniors must be satisfactorily completed in the final year.

Special Honors will be awarded to students who fulfill the general requirements (see page 50) and in addition (1) receive grades of A in at least half of their courses in the two areas of concentration and (2) receive honors in the major examination.

Two years of a foreign language or adequate preparation in statistics, logic, or linguistics is strongly recommended. Students should consult frequently with an American Civilization advisor.

Master of Arts in the field of American civilization—Prerequisite: the degree of Bachelor of Arts with an undergraduate major in American Civilization or in the subject in which concentration is contemplated.

Required: the general requirements, pages 89–96, including (1) AmCv 271–72 (six semester hours), a seminar on scope and method in American Civilization; (2) 18 additional semester hours in a carefully related pattern, focusing on a concentrated approach to the study of American Civilization; (3) a master's thesis (six semester hours) written on an approved topic under the direction of the instructor in whose field the major emphasis falls; (4) a Master's Comprehensive Examination reflecting the candidate's area of concentration. Special options in the degree program include the following:

1. *A concentration in museum training*—Course emphasis on substantive research in material culture under direction of staff at the Smithsonian Institution. Required: in addition to the general requirements outlined above, AmCv 250. Recommended, but not required: AmCv 352 (advanced research), AmCv 251 (internship), and other related courses offered by the Departments of Anthropology, Art, or Education.

2. *A concentration in historic preservation*—Course emphasis on interpreting issues in historic preservation through a humanistic framework. Prerequisite: background in urban history. Required: in addition to the general requirements outlined above, AmCv 277–78. (AmCv 272, however, is not required in this concentration.) Recommended, but not required: additional courses in architectural history, urban and regional planning, and local history.

Master of Arts in the field of museum studies, see pages 384–86.

Doctor of Philosophy in the field of American civilization—This program combines work in the humanities and/or social sciences as preparation for research and teaching, with the option of stressing preparation for museum and library careers. Applicants are required to have an adequate background in the humanities and/or social sciences as they apply to the understanding of American civilization.

Required: the general requirements, pages 89–91, 96–99. Candidates must pass a General Examination in four areas within three calendar years of matriculation. American cultural history is the only required field. Three other fields may be elected with approval of the advisory committee; one field must represent foreign coverage. Other areas may be chosen from the following groups: (1) American diplomatic, economic, political, social, or urban history; folklore, literature, art, philosophy, or religion; Afro-American history; historic preservation; or some areas of the social and behavioral sciences; (2) in affiliation with the Library of Congress—supervised historical study in bibliographic resources including American history and politics, cartography, cross-cultural studies, government documents, graphic arts and music, motion pictures and recorded sound, printing and bookmaking; (3) in affiliation with the Smithsonian Institution (National Museum of American History, National Portrait Gallery, and National Museum of American Art)—supervised studies including architectural history, decorative arts, ethno-history, historical archaeology, history of science, history of technology, industrial archaeology, material aspects of American civilization, and various fields in the history of art. Additional areas of study may be arranged within the University and in both the Library of Congress and Smithsonian cooperative programs. Special announcements concerning these programs are issued periodically and are available in the office of the Director of the American Studies Program.

Research fields for the dissertation may be chosen from any of the above except those dealing with the culture of an area outside the United States.

First Group

71–72 **Introduction to American Civilization** (3–3) Gillette, Mergen
Themes and issues in American civilization since Colonial times, with emphasis on their contemporary importance. (Academic year)

Second Group

115 **Field Program in Mesoamerican Archaeology and History** (6) Humphrey, Mergen
Joint offering of the American Studies Program and the Department of Anthropology. Same as Geog 115. Field study in Mexico and Central America. (Summer)

160-61-62 **Studies in American Literature** (3–3–3) Seavey, Romines, Sten
Same as Engl 160–61–62.

165–66 **Introduction to Folklore** (3–3) Vlach
History, theory, and methods of folklore. AmCv 165: European and African backgrounds to American folklore. AmCv 166: Folklore and folklife of the United States. Same as Anth 165–66. (Academic year)

173 **Afro-American History** (3) Horton
Survey of the Afro-American experience, emphasizing the contributions of black Americans to, and their impact upon, American history. Same as Hist 173. (Fall)

174 **Special Topics in Afro-American History** (3) Horton
Concentration on specific issues central to the Afro-American experience. Consult Spring *Schedule of Classes* for issues to be addressed. Same as Hist 174. (Spring)

177 **Introduction to Historic Preservation** (3) Pearce
Washington, D.C. will be the primary exhibit for the study of historic preservation as it has developed over the past century. Experiences with preservation issues as shown by examples in other localities will also be discussed. Lectures, class discussions of the readings and field trips to neighborhoods and sites subjected to preservation efforts. (Summer)

179–80 **Proseminar in American Civilization** (3–3) Mondale, Walker
Coordinating course for seniors majoring in American Civilization. (Academic year)

184 **Contemporary American Civilization** (3) Staff
Examination of the patterns of contemporary American life through study of literature and the arts, and political, social, cultural, and economic trends.

185 **History of Women in America** (3) DePauw
Same as Hist 185.

186 **U.S. Urban History** (3) Gillette
History of the American city from colonial foundations to the present, focusing on relationships between social and economic forces with physical form. Special emphasis on transitions from pre-industrial to industrial to metropolitan forms, with attention to implications for public policy and historic preservation. Same as Hist 186. (Spring)

192 **The American Cinema** (3) Staff
Same as SpDr 192.

194 **Introduction to Historical Archaeology** (3) Cressey
Joint offering of the American Studies Program and the Anthropology Department. Survey of the basic data and methods of research in the material culture of recent history. (Fall)

195 **Independent Study** (3) Staff
Open to a limited number of American Civilization majors as directed research or as an internship with a Washington museum or historical society. Approval of advisor required. (Fall and spring)

197 **Oral History and Interview Techniques** (3) Gillette, Mergen
Introduction to theory and practice of obtaining and using historical data through recorded interviews. Examination of major published works in oral history. Particular attention to ongoing oral history projects in the Washington area. Same as Anth/Hist 197. (Spring)

198 **Special Topics in American Studies** (3) Staff
May be repeated for credit provided the topics differs. Admission by permission of instructor.

Third Group

215 **Field Program in Mesoamerican Archaeology and History** (6) Humphrey, Mergen
Joint offering of the American Studies Program and the Department of Anthropology. Field study in Mexico and Central America. (Summer)

225 **History of Washington, D.C.** (3) Gillette
The social history of Washington, from village to metropolis, with emphasis through field trips on the evolution of residential neighborhoods and related issues of historic preservation and conservation. Same as Hist 225. (Summer)

254 **Folklore Theory** (3) Vlach
(Formerly Seminar: Folklore in America)
Various aspects of American traditional culture, including the theory and methodology of folklore research. Same as Anth 254. (Spring)

257 **Seminar: American Folklife** (3) Vlach
(Formerly Seminar: Regional Folk Cultures)
Research and discussion on the traditional cultures of various geographical regions of the United States. Theories of regionalism and their relation to the study of folklife and folklore will be considered.

Different regions, such as the West, South, or the Chesapeake will be emphasized in different semesters. Same as Anth 257.

260 **Women in the American Work Force** (3) Palmer
Joint offering of the American Studies Program and the Women's Studies Program. Multidisciplinary historical survey of women's work roles and labor force participation, including social prescriptions for and self-perceptions of women, market and technological factors affecting women's work choices, psychological responses to work roles, and familial organization of work duties. Differential attitudes and experiences by class, race, and ethnic groups. (Fall)

271–72 **Seminar: Scope and Methods in American Studies** (3–3) Mondale
Consideration of American studies as an area for research and teaching; introduction to bibliography. Required of candidates for the degree of Master of Arts in the field of American Civilization. (Academic year)

274 **Research Seminar: Materials in Afro-American Culture** (3) Horton
Joint offering of the American Studies Program and the History Department. Prerequisite: AmCv/Hist 173 and 174 or equivalent. (Spring)

276 **U.S. Architectural History** (3) Staff
Joint offering of the American Studies Program and the Urban and Regional Planning Department. Basic stylistic developments in American architecture from the 17th through the 20th centuries, with special emphasis on the applicability of style recognition to buildings and neighborhoods in urban America. Architecture as evidence of American cultural history and guide to historic preservation. (Fall)

277–78 **Historic Preservation** (3–3) Staff
Joint offering of the American Studies Program and the Urban and Regional Planning Department. Same as Hist 277–78. The preservation movement and its literature. Review of current experience, preservation practice and techniques. Emerging aspects of historic preservation. Examples of historic, cultural, and humanistic values affecting preservation activities. (Academic year)

289–90 **Seminar: Topics in American Civilization** (3–3) Staff
Research problems selected by the instructor. Preparation in American cultural history or other area appropriate to the topic of the seminar. (Academic year)

295 **Independent Study** (arr.) Staff
Limited to master's candidates. Permission of instructor, in writing, required. (Fall and spring)

299–300 **Thesis Research** (3–3) Staff
(Fall and spring)

Fourth Group

351 **Vernacular Architecture** (3) Staff
Examination of selected regional and ethnic traditions in American building. Survey and field techniques, comparative study of related types of objects, and use of documentary sources. (Spring)

379–80 **Readings in American Cultural History** (3–3) Walker
For students preparing for the Doctor of Philosophy general examination in the field of American Civilization. (Academic year)

398 **Advanced Reading and Research** (arr.) Staff
Limited to students preparing for the Doctor of Philosophy general examination. May be repeated for credit. (Fall and spring)

399 **Dissertation Research** (arr.) Staff
Limited to Doctor of Philosophy candidates. May be repeated for credit. (Fall and spring)

COURSES OFFERED IN AFFILIATION WITH THE LIBRARY OF CONGRESS

The Graduate School of Arts and Sciences is affiliated with the Library of Congress in a program leading to the degree of Doctor of Philosophy. The following courses are offered at the Library of Congress by members of its staff:

Third Group

255–56 **Research Orientation Seminar: Americana in the Library of Congress** (3–3) Walker
Examination of the collections of the Library of Congress with the aim of increasing understanding of American culture and awareness of library-oriented research problems and possibilities. For students in the affiliated doctoral program, this course may lead directly to a field in "Research Materials for the Study of American Life: Their Content, Collection, Arrangement, and Use." (Alternate academic years)

Fourth Group

355–56 **Practicum: Advanced Library Research** (3–3)
Practical problems in control of library materials with emphasis on collections in the Library of Congress. A reading field in the affiliated program. Prerequisite: AmCv 255–56. (Academic year)

389 **Advanced Reading and Research** (arr.)
Limited to students preparing for the Doctor of Philosophy general examination in fields offered in affiliation with the Library of Congress. May be repeated for credit. (Fall and spring)

390 **Dissertation Research** (arr.)
For Doctor of Philosophy candidates preparing dissertations based upon or significantly related to collections of the Library of Congress. Supervised by specialists at the Library. Prerequisite: AmCv 355–56. (Fall and spring)

COURSES OFFERED IN AFFILIATION WITH THE SMITHSONIAN INSTITUTION

The Graduate School of Arts and Sciences is affiliated with the Smithsonian Institution's Program for Graduate Students in the History of American Civilization. The following courses are offered at the Museum of History and Technology and at the National Portrait Gallery, by members of their staffs:

Third Group

250 **Orientation Course: Material Aspects of American Civilization** (3) Washburn, Mergen
Familiarization with the historical collections of the Smithsonian Institution and introduction to opportunities for research and publication based on historical objects. Required of all students in the master's and doctoral programs affiliated with the Smithsonian Institution. (Fall)

251 **Museum Research and Education** (3) Washburn and Staff
Supervised work and/or study under the direction of Smithsonian staff members and research associates—museum visitor behavior,

costumes and furnishings, decorative arts, and photography as historical documentation. (Fall and spring)

252–53 **American Decorative Arts** (3–3) Carson
Concepts of visual recognition and evaluation of surviving domestic artifacts from the 17th, 18th, and 19th centuries, including those made of wood, clay, glass, metal, and cloth. AmCv 252 is prerequisite to AmCv 253. (Academic year)

284 **Seminar: Studies in American Art and History** (3) Miller, Field
Joint offering of the American Studies Program and the Art Department. Exploration of selected problems and themes in American cultural history involving the use of artistic materials in different media; emphasis on methodology and analytic techniques. May be repeated for credit.

285 **Technology, Labor, and American Society** (3) Staff
Selected readings on the interrelations among technology, labor, and society in the United States, with special emphasis on the period 1750 to 1900.

294 **Field and Laboratory Research in Archaeology** (3) Cressey
Joint offering of the American Studies Program and the Anthropology Department. Field and/or laboratory techniques and interpretation. Topics may include excavation methods, recording photography, preservation, stratigraphy and environmental reconstruction, typology, use-wear analysis and spatial analysis. Specific research area and topics announced in the *Schedule of Classes*. May be repeated for credit. (Fall and spring)

Fourth Group

352 **Research in Selected Aspects of American Civilization** (3)
Supervised study and/or field work in selected subject areas related to the activities of the Smithsonian Institution. (Fall or spring)

394 **Advanced Reading and Research** (arr.)
Limited to students preparing for the Doctor of Philosophy general examination in fields offered in affiliation with the Smithsonian Institution. May be repeated for credit. (Fall and spring)

395 **Dissertation Research** (arr.)
For Doctor of Philosophy candidates preparing dissertations significantly related to the material aspects of American civilization. Students work under curatorial supervision at the Smithsonian Institution. Prerequisite: AmCv 351–52. May be repeated for credit. (Fall and spring)

ANATOMY—DOCTORAL PROGRAM

Professors F.D. Allan, T.N. Johnson, R.S. Snell *(Chairman)*, E.N. Albert, M.J. Koering
Associate Professors K.E. Johnson, F.J. Slaby
Assistant Professors R.J. Walsh, J.M. Rosenstein

Doctor of Philosophy in the field of anatomy—Required: The general requirements, pages 89–91, 96–99. Candidates must also fulfill tool requirements by demonstrating proficiency in two of the following: a language (German, French, or Russian), biostatistics, computer science, or biological instrumentation. There will also be a comprehensive written and oral examination that will cover at least three areas of anatomical studies.

Research fields: cell ultrastructure, embryology, gross anatomy, histology, neuroanatomy, and physical anthropology.

Faculty approval is required for all courses.

202 Gross Anatomy (6) Snell and Staff
Regional dissections of adult cadaver supplemented with lectures and x-rays. Laboratory fee, $30. (Fall)

203 Human Developmental Anatomy (1) Staff
Origin and development of human body; emphasis on study of human development in interpreting anatomical anomalies. (Fall)

204 Neuroanatomy (2) T. Johnson
Gross and microscopic anatomy of central nervous system and special senses. Laboratory fee, $13.

205 Human Microscopic Anatomy (3) Albert and Staff
Microscopic structure of cells, tissues, and organs of the human body. Laboratory fee, $20. (Fall)

206 Scanning Electron Microscopy (2) Koering
Preparative techniques for various biological tissues, operation of scanning electron microscope, and interpretation of micrographs. Laboratory fee, $30. Enrollment limited. Prerequisite or concurrent registration: Anat 260. (Fall)

208 Comparative Vertebrate Neurology (1) T. Johnson
Survey of the evolution of the vertebrate brain. Prerequisite: Anat 204. Laboratory fee, $10. (Spring)

209 The Use of Audiovisual Techniques in Anatomy (2) Allan
Preparation of a significant audiovisual program about some aspect of human anatomy. Laboratory fee, $20. (Spring)

212 Neurobiology (3) Staff
An integrated survey of the structure and function of the human nervous system; lecture, clinical demonstration, and laboratory. Same as Phyl 212. Laboratory fee, $25.

221–22 Seminar (1–1) K.E. Johnson
Research reports and discussions of special topics by guest lecturers, staff, and students. (Academic year)

249 Introduction to Anatomical Research (1) Staff
Major research techniques as applied to biological materials in the various anatomical disciplines. (Fall)

252 Physical Anthropology (1) Staff
Variations in humans and factors affecting them; human evolution and racial differences; anatomy and culture of ancient humans. (Spring)

253 Brain-Tissue Interactions (1) Walsh, Rosenstein
Interactions of the CNS with the muscular, sensory, and endocrine systems. Student presentations and clinical aspects. Prerequisite: Anat/Phyl 212. (Spring)

254 Fetal Anatomy (2) Allan
Dissection of midgestational fetus. Comparison of fetal and adult structures. Limited enrollment. Laboratory fee, $10. (Spring)

256 Teratology (1) Staff
Introduction to teratologic principles and techniques, with emphasis on experimental design. Limited enrollment.

260 Electron Microscopy in Cellular Biology—Lecture (1) Koering
Introduction to the morphology of the cell and its relationship to electron microscopic techniques. (Spring)

261 Transmission Electron Microscopy (3) Koering
Introduction to the routine processing of specimens; preparation and interpretation of micrographs. Limited enrollment. Admission by permission of instructor. Prerequisite or concurrent registration: Anat 280. Laboratory fee, $25. (Spring)

262 **Gross Anatomy of Upper and Lower Extremities** (2) Snell and Staff
Detailed dissection, supplemented by x-ray anatomy; discussions, assigned reading. Limited enrollment. Laboratory fee, $10. (Spring)

264 **Gross Anatomy of Head and Neck** (2) Snell and Staff
Detailed dissection, supplemented by x-ray anatomy; discussions, assigned reading. Limited enrollment. Laboratory fee, $10. (Spring)

266 **Gross Anatomy of Thorax and Abdomen** (2) Snell and Staff
Detailed dissection, supplemented by x-ray anatomy; discussions, assigned reading. Limited enrollment. Laboratory fee, $10. (Spring)

268 **Gross Anatomy of Pelvis, Perineum, and Lower Extremity** (2) Snell and Staff
Detailed dissection, supplemented by x-ray anatomy; discussions, assigned reading. Limited enrollment. Laboratory fee, $10. (Spring)

270 **Dissection of the Human Brain** (1) T. Johnson
Dissection of major pathways and nuclei of the brain with consideration of ventricular system; conferences and assigned reading. Limited enrollment. Laboratory fee, $10. (Spring)

272 **Autonomic Nervous System** (1) Allan
Development, microscopic and gross anatomy, function of central and peripheral components of autonomic nervous system, with clinical consideration. (Spring)

275 **Advanced Human Embryology** (1) Allan
Microscopic examination of the human embryo at several critical periods during embryogenesis. Limited enrollment. (Spring)

276 **Advanced Studies in Anatomy** (1) Staff
Lectures and conferences on selected anatomical subspecialties—endocrinology, teratology, growth, and others. May be repeated for credit. (Spring)

288 **Surface Anatomy and Radiology** (1) Snell
Lectures and demonstrations on areas of clinical importance. (Spring)

289 **Biochemical and Morphological Techniques in Cell Biology** (3) Slaby
The application of biochemical and electron micrographic techniques used in cell biology research. Limited enrollment.

295 **Research** (arr.) Staff
Content differs each time course is offered; may be repeated once for credit. Fee to be arranged. (Fall and spring)

398 **Advanced Reading and Research** (arr.) Staff
Limited to students preparing for the Doctor of Philosophy general examination. May be repeated for credit. (Fall and spring)

399 **Dissertation Research** (arr.) Staff
Limited to Doctor of Philosophy candidates. May be repeated for credit. (Fall and spring)

ANTHROPOLOGY

Professors R.K. Lewis *(Emeritus)*, R.M. Krulfeld, R.L. Humphrey, Jr. *(Chairman)*, C.M. Turnbull
Professorial Lecturer J.L. Angel
Associate Professors V.K. Golla, S.L. Simons, A.S. Brooks, J.M. Vlach
Associate Professorial Lecturers S. Hertz, G. Teleki, Jr., D. Von Endt
Assistant Professor C.J. Allen

Adjunct Assistant Professors C.R. Rose, P.J. Cressey
Assistant Professorial Lecturers R.O. Selig, P.S. Maloof, M.G. Crabtree, M.S. Boone, R.K. Evans
Adjunct Instructor J. Lanouette
Lecturers A.G. Webster, R.N. Rasnake, S.H. Thompson

Bachelor of Arts with a major in anthropology (departmental)—The following requirements must be fulfilled:

1. The general requirements as stated on pages 71–72, 79–85.
2. Prerequisite course—Anth 1–2.
3. Required courses in other areas—(a) 12 semester hours, or equivalent, of introductory French, German, Russian, or Spanish (or another major language approved by the Anthropology Department); (b) six to twelve semester hours of course work in related departments. Recommended for ethnological emphasis are courses in economics, political science, psychology, and sociology; for archeological emphasis, courses in American civilization, art history, geography and regional science, geology, and history; for emphasis in physical anthropology, courses in anatomy and biological sciences. Courses in philosophy and statistics are strongly recommended for all anthropology majors.
4. Requirements for the major—24 to 36 semester hours in second-group anthropology courses, including Anth 101 and at least one course from each of the following four categories: aspects of culture (courses numbered in the 150s), linguistics (161, 162, 168, or 169), ethnology (courses numbered in the 170s), and physical anthropology or archaeology (courses numbered in the 180s). Students intending to pursue a graduate degree in anthropology should take Anth 157 and at least one course each in archaeology and physical anthropology. Qualified seniors may enroll in 200-level courses with the permission of the instructor. Up to 6 semester hours of ethnographic or archaeological field school credit may be accepted and applied toward the major, if approved by the department, and majors are encouraged to participate in such summer programs. Opportunities also exist for field and laboratory research during the academic year, both within the department and elsewhere in the Washington area. Credit for such work (not to exceed one-quarter of the student's total second-group credit hours in anthropology) may be granted through registration in Anth 195. Seniors in anthropology are urged to enroll in Anth 198, *Senior Seminar*; candidates for graduation with Special Honors must register in Anth 198 or for 3 semester hours of Anth 195, *Undergraduate Research*, and write a paper of special distinction arising out of a program of directed reading or research.

Bachelor of Arts with a major in classical archaeology and anthropology (departmental)—An interdepartmental major offered by the Anthropology and Art Departments. The following requirements must be fulfilled:

1. The general requirements as stated on pages 71–72, 79–85. (Students should consult a departmental advisor regarding courses to be taken in satisfying the requirement for meaningful initiation into the natural and mathematical sciences.)
2. Required courses in other areas: six semester hours, or equivalent, of introductory French, German, Latin, Greek, or a Near Eastern language. A second year of language study is strongly encouraged. Since graduate study in archeology usually involves broader preparation, especially in languages, students intending to pursue graduate study should consult with the departmental advisor as early as possible in their undergraduate programs.
3. Required courses in the major: Anth 180, 183, 184, and one course chosen from Anth 152, 158, 177, or an approved 3-hour course in field-work; four courses chosen from Art 101, 102, 103, 112, 155; two courses chosen from Clas 71, 72, 108, 113, 170; two courses chosen from Hist 107, 108, 109, 110 (students electing Hist 108 should previously have completed Hist 107 or 109).

Minor in general anthropology—21 credit hours are required, including Anth 1–2, 101, and four additional semester courses in anthropology, no more than two of which may be taken in the same subdiscipline. (For the purposes of this minor the department's second-group courses may be divided into subdisciplines as follows: biological anthropology—Anth 186, 187, and 188; archeology—Anth 180, 182, 183, 184, 185, 190, and 194; anthropological linguistics—Anth 161, 162, 168, and 169; socio-cultural anthropology—all other second-group courses, with the exception of Anth 195, 196, and 198, in which the topic is variable.)

Minor in archaeology—18 credit hours are required, including Anth 1 and 180; three courses chosen from Anth 182, 183, 184, 185, 190, and 194; an approved field or research course or a fourth course chosen from the preceding list.

Minor in biological anthropology—15 to 18 credit hours are required, including Anth 1, 186, 187, and 188; an approved field or research course or an approved course or course sequence in a related field (including biological sciences, geology, psychology, statistics, and certain other disciplines).

Minor in socio-cultural anthropology—18 credit hours are required, including Anth 2 and 101; one course in ethnography (Anth 170–179); Anth 151 or 152; Anth 156 or 157; one course chosen from Anth 150, 153, 155, 158, or 159.

Minor in cross-cultural communication—18 credit hours are required, including Anth 2, 161, 162; Anth 150 or 159; one course in ethnography (Anth 170–179); one course chosen from Anth 153, 155, 158, 163, 165, or 168. Psyc 115 is recommended.

Master of Arts in the field of anthropology—Prerequisite: a bachelor's degree; a major in anthropology is preferred but not mandatory. The undergraduate program should have included courses above the introductory level in anthropological theory, social organization, linguistics, archaeology, and physical anthropology. Students with less background in anthropology may be admitted, but may be required to take one or more undergraduate courses to make up deficiencies before beginning the degree program.

1. *General degree*—Required: the general requirements, pages 89–96. The minimum requirement consists of 24 semester hours of approved graduate course work, plus a thesis (equivalent to 6 semester hours). A thesis is preferred; under certain circumstances, however, the department may permit a program of study consisting of 36 semester hours of approved course work without a thesis. At least 6 semester hours drawn from the sequence Anth 201, 202, 203, 204 should be included in the program of study and should be completed during the first 24 semester hours of graduate course work. A reading knowledge examination in a major foreign language must be passed before beginning the third semester of graduate work. A tool course in statistics, computer programming, or a similar technical field may be substituted for the foreign language reading examination, if approved by the department. A written general Master's Comprehensive Examination must be passed before beginning the 26th semester hour of graduate work.

2. *With a concentration in museum training*—Required: the general requirements, pages 89–96. The program of study is the same as that described for the general degree, above, with the following exceptions: the minimum requirement consists of 36 semester hours of approved graduate course work, and must include from 12 to 15 semester hours of work in museum-related courses, 6 semester hours of which may be in an internship. In addition to the tool options described above, museum training students may substitute for the foreign language reading examination an appropriate course in chemistry or photography, if approved by the department. No thesis is required, but students are expected to submit to the department at least one research paper of publishable quality on a museum-related topic. Students whose primary interest is in museum techniques, rather than anthropology, are advised to apply to the Master's program in museum studies (pages 384–86).

Course accessibility: Anth 115, 152, 161, 162, 165–66, 168, 169, 180, 182, and 185 may be taken without anthropology course prerequisites; Anth 1 is prerequisite to Anth 186, 187, and 188; Anth 1 or 180 is prerequisite to Anth 183–84; Anth 1 and 2 are prerequisite to Anth 101; Anth 2 or the permission of the instructor is required for all other second-group courses.

First Group

1–2 **Introductory Anthropology** (3–3) Staff
Anth 1: survey of human origins, physical evolution, and culture history. Anth 2: survey of the world's cultures, illustrating the principles of cultural behavior. (Anth 1 and 2—fall and spring)

Second Group

101 **Survey of Anthropological Theory** (3) Allen, Krulfeld, Golla
The development of anthropological thought as seen in historical context. Exploration of selected basic concepts and theories of contemporary anthropology. (Fall)

115 **Field Program in Mesoamerican Archaeology and History** (6) Humphrey, Mergen
Joint offering of the American Studies Program and the Department of Anthropology. Same as Geog 115. Field study in Mexico and Central America. (Summer)

150 **Comparative Value Systems** (3) Krulfeld
World views, conceptual systems, and value orientations of representative cultures throughout the world.

151 **Primitive Economics** (3) Krulfeld
Comparative study of various economic organizations, including hunters and gatherers, herders, and cultivators. (Fall, odd years)

152 **Man, Culture, and Environment** (3) Humphrey
Basic principles of cultural ecology. Human interaction with the ecosystem both past and present; emphasis on the application of anthropological precepts to current environmental problems.

153 **Psychological Anthropology** (3) Simons
Relevance of psychological theories to human evolution and the cross-cultural study of personality. Cultural determinants of personality formation and mental health. (Spring)

155 **Anthropological Approaches to Religion** (3) Simons, Allen, Turnbull
Theories of religion developed by anthropologists; survey of world religions with emphasis on preliterate societies; religious processes and change. Same as Rel 155. (Spring)

156 **Comparative Political and Legal Systems** (3) Hertz, Simons
Comparative analysis of political systems, including bands, tribes, chiefdoms, and states; political processes such as factionalism, styles of leadership, and political ritual; primitive warfare; law. (Spring)

157 **Primitive Social Organization** (3) Simons, Hertz
Analysis of the social organization of primitive peoples; kinship, economic, and political systems. (Fall)

158 **Art and Culture** (3) Krulfeld, Humphrey, Allen
The art of tribal society, including the role of art in culture, influences upon the artist, and beliefs and practices associated with art production. (Fall)

159 **Symbolic Anthropology** (3) Allen
The study of culture through the analysis of symbolic systems including myth, cosmology, folklore, art, ritual, political symbolism, and the symbolic study of kinship. (Fall, odd years)

161 **Language and Culture** (3) Golla
The origin and evolution of human language; varieties of linguistic structure; comparative semantic systems; writing. (Fall)

162 **Language and Society** (3) Golla
Linguistic variation and change; social and political correlates of linguistic differences; language in history. (Spring)

163 **Anthropology of Visual Communication** (3) Staff
Still and motion picture photography as an integral aspect of anthropological research. A study of recent and historic ethnographic films and an introduction to the forms and methods of making visual ethnographic records. Material fee, $15.

165–66 **Introduction to Folklore** (3–3) Vlach
History, theory, and methods of folklore. Anth 165: European and African backgrounds to American folklore. Anth 166: Folklore and folklife of the United States. Same as AmCv 165–66. (Academic year)

168 **Methods of Linguistic Analysis** (3) Golla
Phonetics, grammatical analysis, principles of lexicography, techniques of linguistic reconstruction, and other tools of anthropological linguistic research. (Fall)

169 **Intensive Study of a Language** (3) Golla
Analytic study of a selected language, ordinarily one not frequently studied in a university context, as an illustration of the methods of anthropological linguistics. Prerequisite: Anth 168. (Spring or summer)

170 **Cultures of the Caribbean** (3) Lewis
Culture history and ways of life among the area's various cultural groups up to the ethnographic present. (Summer)

171 **Native Peoples of North America** (3) Simons, Humphrey
Comparative study of Indian groups representative of each of the continent's culture areas. (Fall)

172 **Cultures of South America** (3) Allen
Comparative study of native American, Iberian, and African cultures of South America, and their interactions. Emphasis on world view, interethnic relations, and culture change. (Fall)

173 **Cultures of the Pacific** (3) Lewis
Culture history and ways of life among native peoples of Melanesia, Micronesia, and Polynesia. (Fall, odd years)

175 **Topics in Asian and Circumpolar Ethnography** (3) Humphrey, Krulfeld, and Staff
Intensive, integrated study of a selected culture area in or around Asia (including Circumpolar regions). Specific area to be announced in the *Schedule of Classes*. May be repeated for credit.

177 **Cultures of the Near East** (3) Lewis
Geographic environment, language, religion, and social structure of settled and nomadic peoples of the Near East; emphasis on the Arab world. (Spring)

178 **Cultures of Africa** (3) Lewis, Hertz, Turnbull
Comparative examination of the history, cultural development, and contemporary problems of sub-Saharan African cultures.

180 **General Archaeology** (3) Humphrey, Brooks, Evans
Field and laboratory methodology in archaeology: stratigraphy, dating techniques, chronological systems and their implications; a brief survey of world prehistory.

182 **New World Archaeology** (3) Humphrey
Introduction to archaeological methodology, theory, and survey of North American culture history from human entry into the Americas during the Pleistocene period until the time of the first European contacts. (Spring)

183–84 **Old World Prehistory** (3–3) Brooks, Evans
Survey of human prehistory in Europe, Africa, and Asia from the earliest hominid cultures to the beginnings of advanced civilizations. Anth 183: Paleolithic and Mesolithic cultures. Anth 184: Neolithic and Bronze Age cultures. (Academic year)

185 **Latin American Archaeology** (3) Humphrey, Allen
Culture history of pre-Columbian Latin America from the Paleo-Indian period through the Spanish Conquest. Focus on Andean South America in even years, on Meso-America in odd years. May be repeated for credit.

186 **Physical Anthropology of Modern Man** (3) Angel
Individual and social biology, methods, and techniques. Genetic, cultural, and ecologic backgrounds of individual and population variation: micro-evolution, growth, paleodemography, paleopathology, forensic identification, techniques. (Spring)

187 **Introduction to Hominid Evolution** (3) Brooks
The fossil record of hominid evolution considered in the light of evolutionary theory. Brief review of the earlier human antecedents, with concentration on the Pleistocene remains. (Spring, even years)

188 **Primatology** (3) Brooks, Teleki, Thompson
Physical and behavioral characteristics of the various primate groups and their relationship to human physical and cultural evolution. Frequent meetings at the National Zoological Park. (Fall)

190 **Ethnohistory** (3) Allen, Humphrey
Reconstruction of the history of a selected preliterate society through the analysis of historical documents, oral traditions, archaeological remains, and other indirect sources. Specific topic to be announced in the *Schedule of Classes*. Same as Hist 190.

194 **Introduction to Historical Archaeology** (3) Cressey
Joint offering of the American Studies Program and the Anthropology Department. Survey of the basic data and methods of research in the material culture of recent history. (Spring)

195 **Undergraduate Research** (arr.) Staff
Individual research problems to be arranged with a member of the faculty. May be repeated for credit.

196 **Special Topics in Anthropology** (3) Staff
Courses offered by visiting faculty; experimental offerings. Topic to be announced in the *Schedule of Classes*. May be repeated for credit.

197 **Oral History and Interview Techniques** (3) Mergen
Same as AmCv/Hist 197.

198 **Senior Seminar** (3)
Study and discussion of selected major works in anthropology. Prerequisite: Anth 101 and senior standing in anthropology.

200 **Methods in Socio-Cultural Anthropology** (3) Krulfeld
Approaches to library and field research. Conceptual bases and biases in the delineation of problems and in the selection, analysis, and organization of data. Students will design and carry out their own field projects in the Washington area. (Spring)

Third Group

201 Proseminar: Biological Anthropology (3) — Brooks
Theories, methods and current issues in the various subdisciplines of biological anthropology. (Spring)

202 Proseminar: Socio-Cultural Anthropology — Krulfeld, Simons
Major topics in contemporary social and cultural anthropology, stressing current journal and monograph materials. (Spring)

203 Proseminar: Anthropological Linguistics (3) — Golla
Contemporary anthropological studies of language in biological, social, and historical perspectives. (Fall)

204 Proseminar: Method and Theory in Archaeology (3) — Humphrey, Brooks
Survey of the most recent archaeological techniques and theoretical approaches to reconstructing and interpreting the cultures of the past. (Fall)

211 Seminar: Problems in Conservation (3) — Rose
Joint offering of the Anthropology and Art Departments. Individual conservation projects to determine composition, construction, decomposition of materials, and possible stabilization techniques. Conservation laboratory experience. Prerequisite or concurrent registration: Art or Anth 212. (Fall)

212 Advanced Conservation Techniques (3) — Von Endt
Joint offering of the Anthropology and Art Departments. Physical structure, molecular biology, and chemistry of ethnographic materials. Chemistry and physics underlying techniques used to conserve these materials. Prerequisite: Art or Anth 293, Chem 50, and permission of instructor. (Fall)

215 Field Program in Mesoamerican Archaeology and History (6) — Humphrey, Mergen
Joint offering of the American Studies Program and the Department of Anthropology. Field study in Mexico and Central America. (Summer)

220 The Anthropology of Development (3) — Krulfeld
The role of anthropology in development, including social factors crucial to the understanding and resolution of problems in Third World societies (including rural social systems, ideologies, economic change, ecology, women's roles, nutrition, population, and migration). The potential role of anthropology in planning, feasibility studies, and implementation of development projects. (Fall)

221 Key Variables in the Development Process (3)
Major factors required for anthropologists' development work in the areas of population, education, agriculture, irrigation, forestry, nutrition, health care, migration and resettlement, marketing, and communications. Isolation and study of the major variables and processes in each area to aid in successful planning, feasibility study, implementation and evaluation. (Spring)

222 Issues in Development (3)
Topic to be announced in the *Schedule of Classes*.

254 Folklore Theory (3) — Vlach
Various aspects of American traditional culture, including the theory and methodology of folklore research. Same as AmCv 254. (Spring)

255–56 Anthropology for Teachers (4–4) — Lanouette and Staff
Examination of current research, innovative classroom techniques and materials. Sessions with anthropologists at museums, laboratories, and zoos. Designed for middle and secondary school social science

and science teachers. Admission by special application. May not be taken for credit by M.A. candidates in arthropology. (Academic year)

257 **Seminar: American Folklife** (3) Vlach
(Formerly Seminar: Regional Folk Cultures)
Research on and discussion of the traditional cultures of various geographical regions of the United States. Theories of regionalism and their relation to the study of folklife and folklore will be considered. Different regions, such as the West, South, or the Chesapeake will be emphasized in different semesters. Same as AmCv 257.

258 **Seminar: Anthropology of Art, Aesthetics, and Symbolism** (3) Allen, Krulfeld
Anthropological approaches to aesthetic problems and theories of symbolism in the context of ethnographic materials.

260 **Seminar: Culture Theory** (3) Krulfeld, Allen
Contemporary theories of culture. Intensive study of major works.

262 **Seminar: Applied Anthropology** (3) Lewis
Use of anthropological methods and techniques in such specific fields as government, community development, land reform, law, and medicine. (Fall)

263 **Seminar: Culture Contact and Change** (3) Simons, Turnbull
Change in Western and non-Western cultures; emphasis on general processes of change and interaction between simpler and more complex societies. (Fall)

264 **Seminar: Anthropological Museum Techniques** (3) Humphey, Turnbull
Principles of anthropological collection, classification, preservation, identification, interpretation, and exhibition of specimens; research and instructional use of the museum. Field trips to area museums. (Fall)

266 **Seminar: Technology** (3) Humphrey, Lewis
Cross-cultural examination of the form, function, meaning, and use of material culture and the behavior patterns involved in its production. (Spring, odd years)

267 **Seminar: Economic Anthropology** (3) Krulfeld
Comparative study of systems of production, distribution, and consumption. (Fall)

268 **Seminar: Peasant Society** (3) Krulfeld
Cross-cultural analysis of peasant societies, including their manner of functioning within their larger social, economic, and cultural context. (Fall)

269 **Seminar: Structural Problems** (3) Simons
Selected topics in social anthropology, including kinship, political, and legal principles of group formation. Emphasis may be given to model building, network analysis, incest, ethnoarchaeology, or other major social concerns. (Spring)

272 **Seminar: Topics in Latin American Anthropology** (3) Allen, Koch-Weser
Specific topics, to be announced, will be selected from the following: mythology and ritual, artistic traditions, ethnic groups, Andean or Tropical Forest social organization, peasant movements and land reform, native cultures during the Colonial period, archaeological problems.

273 **Seminar: Urban Anthropology** (3) Hertz
A review of the literature on urban kin groups, occupational/class

and ethnic communities, migrant adaptations; the nature of urbanism; urban poverty; urban field methods. (Spring)

274 **Seminar: Topics in American Culture** (3) Hertz
Review of anthropological literature on American world view, mainstream and alternate forms of kinship, selected ethnic groups, and the effects of sex, age, class, occupation, and politics on American life. (Fall)

282 **Seminar: Advanced Archaeology—New World Prehistory** (3) Humphrey
Current archaeological problems relating to the origin and development of aboriginal cultures. Specific topic to be announced in the *Schedule of Classes*. May be repeated for credit.

283 **Seminar: Topics in Old World Anthropology—Physical Anthropology and Archaeology** (3) Brooks
Current problems in relation to materials from the old world. Specific area to be announced in the *Schedule of Classes*. (Spring)

287 **Seminar: Problems in Latin American Civilization** (3) Staff
Same as Econ/Geog/Hist/Rom 287, and PSc 285. Interdisciplinary seminar; each student writes a report on some aspect of a selected key theme. May be repeated for credit. Admission by permission of instructor. (Fall and spring)

290 **Advanced Museum Research** (3) Staff
Supervised individual research and/or field work at the Smithsonian Institution or other area museums, arranged in consultation with the museum and the Anthropology Department. Admission by permission of the department chairman. May be repeated for credit. (Fall and spring)

291 **Anthropology in the Museum** (3) Evans
Anthropological materials (in the broadest sense), exhibits, and museums. Topics include: museum anthropology, collections, research, interpretation, and education, with a focus on the practical problems of developing an anthropological exhibit hall. (Spring)

292 **Introduction to Conservation** (3) Rose
Joint offering of the Anthropology and Art Departments. Method and theory of conservation, including fine arts, ethnographic archaeological and monuments conservation; handling, restoration, preservation, storage, and display of museum specimens; basic materials of museum objects and the ways they react to their environment. The summer course deals with conservation of archaeological materials. (Fall, spring, and summer)

293 **Preventive Conservation Techniques** (3) Rose
(Formerly Conservation Laboratory Techniques)
Joint offering of the Anthropology and Art Departments. Practical aspects of preventive conservation such as monitoring environmental conditions with measuring and recording devices; examining objects and documenting their conditions (including photography); and identifying sources of deterioration for various materials. Students will conduct tests, evaluate exhibition and storage areas, and participate in improving and correcting museum conditions. Prerequisite: Anth Art 292. (Spring)

294 **Field and Laboratory Research in Archaeology** (3) Cressey
Joint offering of the Anthropology Department and the American Studies Program. Field and/or laboratory techniques and interpretation. Topics may include excavation methods, recording, photography, preservation, stratigraphy and environmental reconstruction, typol-

ogy, use-wear analysis, and spatial analysis. Specific research area and topics announced in the *Schedule of Classes*. May be repeated for credit. (Fall and spring)

295 **Research** (arr.) Staff
May be repeated for credit. (Fall and spring)

298 **Dumbarton Oaks Courses** (arr.)
Courses offered each year by scholars in residence at Dumbarton Oaks, Trustees for Harvard University, are open to qualified graduate and undergraduate students with permission of department chairman. Topics will be announced in the *Schedule of Classes*. May be repeated for credit provided the topic differs.

299–300 **Thesis Research** (3–3) Staff
(Fall and spring)

ART

Professors L.P. Leite *(Emeritus)*, F.S. Grubar, D.H. Teller, L.F. Robinson *(Chairman)*
Professorial Lecturers Grace Evans, D.A. Brown, L. Miller
Associate Professors H.I. Gates, J.L. Lake, J.F. Wright, Jr., A.H. Smith, T. Ozdogan, D.M. Hitchcock, J.C. Anderson
Adjunct Associate Professors Grose Evans, A.D. Ullberg
Associate Professorial Lecturers B.S. Glassman, D. Von Endt, M.S. Kernan
Assistant Professors W.T. Woodward, F. Griffith, C.C. Costigan, B. Von Barghahn, S.B. Molina, M.P. Lader, E.R. Williams, J.L. Stephanic *(Visiting)*
Adjunct Assistant Professor C.R. Rose
Assistant Professorial Lecturers E.L. Battaglia, E.P. Lawson, K. Montgomery, L. Smith, A.B. Barnhart, A.L. Glassman, C. Smigrod, B.G. Carson, W.L. Lebovich, C.R. Smith, N.W. Merritt, M.J. Francis, B.R. Wendel, R.C. Ansell, J.F. Harrop
Curator, Dimock Gallery L.D. Miller

Bachelor of Arts with a major in art history (departmental)—The following requirements must be fulfilled:

1. The general requirements as stated on pages 71–72, 79–85. Students should consult their departmental advisor regarding courses to be taken to satisfy requirements.
2. Prerequisite courses—Art 31–32 and 71 or 72.
3. Required courses in related areas—Art 137; Fren 1–2, 3–4, or Ger 1–2, 3–4; Phil 162; or equivalent.
4. Required courses in the major—Art 101 and 102, 104 or 105, 106 or 107, 108, 109 or 110, 113 or 114, 117 or 118 or 119, 129; nine additional semester hours in second-group art history courses.
5. A maximum of nine semester hours in Fine Arts, including Art 137, is permitted.

Graduation with Special Honors: Students must satisfy the general requirements (see page 50). They should apply to the chairman of the department at the beginning of their senior year. Before admittance to the program, they must pass a reading examination in either French or German. Upon acceptance, candidates will be assigned to one or more faculty advisors under whose direction they will undertake a supervised program of study.

Bachelor of Arts with a major in Fine Arts (departmental)—The following requirements must be fulfilled:

1. The general requirements as stated on pages 71–72, 79–85. Students should consult their departmental advisor regarding courses to be taken to satisfy requirements.
2. A total of 54 hours of art courses is required of Fine Arts majors as stated below.
3. Required basic Fine Arts courses: Art 21–22 and 41–42.
4. Required courses in art history: Art 31–32; six additional semester hours in second-group art history courses.
5. Required Fine Arts courses in the major—30 semester hours of first- or second-group Fine Arts courses.
   a. 15 hours, exclusive of primary area of concentration, in five of the following eight areas—ceramics, advanced drawing, advanced design, graphics, painting, photography, sculpture and visual communication.
   b. 15 hours to be taken in the primary area of concentration.
   c. Students concentrating in photography must take Art 23, 24, 181, 205, 206.
6. Six additional hours of electives may be taken in the Art Department.
7. Transfer students must take at least 12 semester hours of second-group Fine Arts courses and 9 semester hours in their area of specialization at this University.

Graduation with Special Honors: Students must satisfy the general requirements (see page 50). They should apply in writing to the chairman of the Art Department at the beginning of their senior year. Upon acceptance, each candidate will be assigned one or more faculty advisors under whose direction a project in a special area of interest will be undertaken.

Bachelor of Arts with a major in classical archaeology and anthropology (departmental)—An interdepartmental major offered by the Art and Anthropology Departments. The following requirements must be fulfilled:

1. The general requirements as stated on pages 71–72, 79–85. Students should consult their departmental advisor regarding courses to satisfy requirements.
2. Required courses in other areas: six semester hours, or equivalent, of introductory French, German, Latin, Greek, or a Near Eastern language. A second year of language study is strongly encouraged. Since graduate study in archaeology usually involves broader preparation, especially in languages, students intending to pursue graduate study should consult with the departmental advisor as early as possible.
3. Required courses in the major: Anth 180, 183, 184, and one course chosen from Anth 152, 158, 177, or an approved 3-hour course in field-work; four courses chosen from Art 101, 102, 103, 112, 155; two courses chosen from Clas 71, 72, 108, 113, 170; two courses chosen from Hist 107, 108, 109, 110 (students electing Hist 108 should previously have completed Hist 107 or 109).

Bachelor of Arts with a major in classical archaeology and classics (departmental)—An interdepartmental major offered by the Art and Classics Departments. The following requirements must be fulfilled:

1. The general requirements as stated on pages 71–72, 79–85. Students should consult their departmental advisor regarding courses to be taken to satisfy the requirements.
2. Prerequisite courses—Clas 1–2, 3, 4; or Clas 11–12, 13–14.
3. Required courses in the major—Art 101, 102, 112, 155; three courses selected from Hist 107, 108, 109, 110, 209; 12 semester hours in second-group courses in Greek or Latin (a reading knowledge of French and German is recommended).

Master of Arts in the field of art history—Prerequisite: a Bachelor of Arts degree with a major in art history from this University, or an equivalent degree.

Applicants from other institutions must present scores on the Graduate Record Examination to the Office of the Graduate School of Arts and Sciences.

1. *With a concentration in classical art and archaeology, medieval art, Renaissance and Baroque art, eighteenth- and nineteenth-century art, contemporary art, and American art*—Required: the general requirements, pages 89–96; 36 hours of course work including six semester hours of thesis research. As many as possible of the 36 semester hours of course work should be in third-group courses; not more than six hours may be taken in museum-related courses. Students must maintain a quality-point index of at least 3.25. A reading knowledge examination in German or French must be passed before completion of the first nine semester hours of course work. A written general Master's Comprehensive Examination must be passed before students can enroll for the six semester hours of thesis research. A written thesis must be submitted to and approved by the faculty.

2. *With a concentration in museum training*—Required: the general requirements, pages 89–96; 42 semester hours of course work as follows: 12 hours of art history courses, taken before acceptance into the museum program; Art 201–2 and 271–72, and 18 additional hours of art history courses selected in consultation with the advisor, not more than six hours to be taken in museum-related courses. Students must maintain a quality-point index of at least 3.25. A reading knowledge examination in German or French must be passed before completion of the first nine semester hours of course work. Students are required to pass the general written Master's Comprehensive Examination in Art History and may also be required to pass a written comprehensive examination in Museology as part of the requirements for the internship.

Acceptance into this program as a degree candidate is provisional, pending satisfactory completion of 12 semester hours of graduate art history courses and the approval of the Graduate Programs Committee (Department of Art).

The Art Department has established a program of study in affiliation with a number of museums and galleries including the Corcoran Gallery of Art, the Hirshhorn Museum and Sculpture Garden, the Museum of African Art, the National Museum of American Art, the Phillips Collection, the Renwick Gallery, and the Textile Museum.

3. *With a concentration in museum administration*—For details consult the chairman of the department.

Master of Fine Arts in the field of ceramics, design, graphics, painting, photography, sculpture, and visual communication—Prerequisite: a Bachelor of Fine Arts or a Bachelor of Arts degree with a major in Fine Arts in the field of ceramics, design, drawing, graphics, painting, photography, sculpture or visual communication. A 3.00 undergraduate grade-point average (on a 4.00 scale) and departmental approval of the applicant's work is required. This should consist of slides of at least 10 drawings, including figure studies, and four to six paintings, prints, sculptures, ceramics, or photographs. Students planning to do graduate work in graphics or painting must have completed 12 semester hours of drawing at the undergraduate level before admittance to the master's program.

Required: the general requirements, pages 89–96. As a tool requirement Master of Fine Arts candidates must take Art 137 or three additional hours of course work selected in consultation with the advisor. As many as possible of the remaining 24 hours of course work should be in third-group courses, only 18 hours of which may be in one area; the remaining six hours are to be selected from related areas in consultation with the advisor. A creative thesis consisting of the execution of original works of art in ceramics, design, graphics, painting, photography, sculpture, drawing, or visual communication will be completed under the supervision of a thesis advisor. In addition, the thesis must include a written statement and analysis of artistic purpose, subject to the

approval of the thesis advisor and a second faculty reader. A representative portion of the work illustrating the creative thesis may be retained by the University at the discretion of the thesis director in agreement with the second reader.

Doctor of Philosophy in the field of art history—Required: the general requirements, pages 89–91, 96–99, and a Master of Arts degree in art history. Candidates must also pass written examinations in French and German, a General Examination in art history, an examination in the area of specialization, and examinations in two areas related to the area of specialization. Students plan their own programs in consultation with a departmental committee.

Areas of Specialization: classical art and archeology, Medieval art, Renaissance art, Baroque art, eighteenth-century art, nineteenth-century art, twentieth-century art, and American art.

Bachelor of Arts in Education and Human Development with a teaching field in art—Prerequisite: the education curriculum, pages 111–12.

Required: the art option and professional courses listed on page 115.

ART HISTORY

First Group

1 **Principles of Art** (3) Von Barghahn
An introduction to various art media, basic elements of art and thematic interpretations, European and non-Western traditions. (Fall and spring)

31–32 **Survey of Western Art** (3–3) Robinson and Staff
A foundation for further study in the history of art. Art 31: prehistoric to Gothic art. Art 32: proto-Renaissance to modern art. (Art 31 and 32—fall and spring)

71–72 **Introduction to the Arts in America** (3–3) Grubar and Staff
Art 71: Colonial beginnings to the Republican Age. Art 72: 19th century to the present. (Art 71 and 72—fall and spring)

Second Group

101 **Greek Art and Archaeology** (3) Williams
A study of the major achievements in architecture, sculpture, painting, and mosaics from 1000 B.C. to the Roman period. Special focus on the Parthenon and fifth-century Athens. Attention to recent discoveries and current excavations. (Fall)

102 **Roman Art and Archaeology** (3) Williams
Investigation of the architecture, sculpture, wall paintings, and mosaics from the second century B.C. to ca. 350 A.D. Consideration both of the city of Rome and of the monuments and society in the provinces. Attention to current excavations, including Pompeii and Herculaneum. (Spring)

103 **The Ancient Artist and His Workshop** (3) Williams
A study of the ancient craftsman's techniques, workshop organization, and position in society. Exploration of sculpture, architecture painting, pottery, mosaics, gems, glass, and metalwork.

104 **Renaissance Art in Italy I** (3) Grace Evans
Early developments from the 13th to the 15th century. (Fall)

105 **Renaissance Art in Italy II** (3) Grace Evans
High Renaissance and Mannerism. (Spring)

106 **Renaissance Art in the North I** (3) Hitchcock
Northern painting from van Eyck through the Antwerp Mannerists. (Fall)

107 **Renaissance Art in the North II** (3) Hitchcock
Northern painting and graphics from Dürer through Brueghel. (Spring)

108 **18th-Century Art in Europe** (3) Hitchcock
(Spring)

109 **19th-Century Art in Europe I** (3) Robinson
Examination of Neoclassicism and Romanticism in the context of Western European historical and cultural developments. Emphasis on France, England, and Germany, and the representative styles of David, Ingres, Delacroix, Turner, Constable, and Friedrich. (Fall)

110 **19th-Century Art in Europe II** (3) Robinson
(Formerly Contemporary Art)
Examination of the revolution in style of Realism, Impressionism, and Post Impressionism in the context of Western European political, social, and cultural developments. Emphasis on representative styles of Courbet, Manet, Monet, Cezanne, Van Gogh, and Gauguin. (Spring)

111 **Classical Archaeology** (3) Williams
Archaeological monuments of classical civilizations, with intensive study of one or more areas selected from architecture, sculpture, painting, or minor arts.

112 **Egypt and the Ancient Civilizations** (3) Williams
Exploration of the arts of Egypt, Sumeria, the Hittites, Assyria, and Persia, from 3000 to 400 B.C. Emphasis on the age of the Pyramids and the period of Tutankhamen. (Fall)

113 **Baroque Art in Italy** (3) Grose Evans
(Spring)

114 **Baroque Art in the North** (3) Hitchcock
Concentration on France, Flanders, and Holland, with emphasis on Poussin, Rubens, Van Dyck, and Rembrandt. (Fall)

115 **Christian Iconography** (3) Anderson
Origins and development of Christian symbols and themes from early Christian to modern times.

116 **Islamic Art** (3) Staff

117 **Medieval Art I** (3) Anderson
Early Christian and Byzantine. (Fall)

118 **Medieval Art II** (3) Anderson
Romanesque and Gothic. (Spring)

119 **Pre-Romanesque Art in the North** (3) Anderson
Merovingian and Carolingian. (Spring)

120 **East Asian Art** (3) Staff
May be repeated for credit when content differs.

121 **Spanish Art I** (3) Von Barghahn
Discussion of areas selected from the art of ancient Iberia through the seventeenth century. Specific topic to be announced in the *Schedule of Classes*. May be repeated for credit provided the content differs.

122 **Spanish Art II** (3) Von Barghahn
Discussion of areas selected from the eighteenth through twentieth centuries. Specific topic to be announced in the *Schedule of Classes*. May be repeated for credit provided the content differs.

129 **20th-Century Art in Europe** (3) Lader
(Formerly Principles of Museum Work)
Survey of 20th-century European painting, sculpture, and architec-

ture, from their origins in the late 19th century through Surrealism. Emphasis on major modernist movements and artists, including Matisse, Picasso, Kandinsky, and Mondrian. (Fall)

130 **20th-Century American Art** (3) Lader
(Formerly Principles of Museum Work)
Survey of 20th-century American painting and sculpture, focusing upon the avant-garde. Emphasis on artists of the Stieglitz circle and later modernist movements such as Abstract Expressionism, Pop, Op, Minimal, and Conceptual art. (Spring)

140 **Gothic Architecture** (3) Staff

145 **Folk Arts in America** (3) Grubar
Ceramics, woodcarving, ironwork, decorative painting, weaving, and other crafts.

147 **Primitive Art I: Ancient Civilizations of Mexico and Latin America** (3) Von Barghahn
Survey of Pre-Columbian art and architecture from prehistoric period to the Spanish conquest, inclusive of Yucatan and Central American regions.

148 **19th-Century American Painting** (3) Grubar
(Fall)

149 **19th-Century American Sculpture** (3) Grubar
(Spring)

150 **Landmarks in American Art** (3) Grubar

155 **The Aegean Civilizations** (3) Williams
An introduction to the excavational and multidisciplinary aspects of classical archaeology. Minoan and Mycenaean civilizations (1700–1200 B.C.). Interrelationships between Greek and Persian cultures of the sixth and fifth centuries B.C. (Spring)

156 **Early Medieval Sculpture** (3) Grace Evans

161 **Studies in Renaissance Art** (3) Grace Evans

162 **Principles of Museum Work** (3) Lawson
(Formerly The Art of Oriental Rugs)
Introduction to the history and development of museums: problems of museum administration, connoisseurship, cataloguing, installation, conservation, and educational service.

165 **Primitive Art II: African, Oceanic, North American Indian** (3) Von Barghahn
Survey of architecture, sculpture, and painting from ancient kingdoms to early 20th-century culture. Emphasis upon imagery and iconography.

167 **The Dynastic Courts of Europe** (3) Von Barghahn
(Formerly French Painting: 15th and 16th Centuries)
Politics and royal patronage, 1400–1800. Spain, Portugal, Austria, Germany, Russia.

169–70 **History of Decorative Arts** (3–3) Carson
(Academic year)

173 **History of the Cinema** (3) Staff
Same as SpDr 173.

192 **The American Cinema** (3) Staff
Same as SpDr 192.

Third Group

201–2 **Museum Projects** (3–3) Staff
Open only to candidates for the degree of Master of Arts in the field of museum training.

203 **Primitive Art** (3) Staff
(Spring)

207 **Modern Architecture** (3) Lader
Europe and America.

211 **Seminar: Problems in Conservation** (3) Rose
Joint offering of the Art and Anthropology Departments. Individual conservation projects to determine composition, construction, decomposition of materials, and possible stabilization techniques. Conservation laboratory experience. Prerequisite or concurrent registration: Art or Anth 212. (Fall)

212 **Advanced Conservation Techniques** (3) Von Endt
Joint offering of the Art and Anthropology Departments. Physical structure, molecular biology, and chemistry of ethnographic materials. Chemistry and physics underlying the techniques used to conserve these materials. Prerequisite: Art or Anth 293, Chem 50, and permission of the instructor. (Fall)

216 **Medieval Painting** (3) Grace Evans
Painting and the decorative arts.

217–18 **Problems in Museum Work** (3–3) Ullberg
Art 217 is prerequisite to Art 218.

*220 **Seminar: Baroque Art of the 17th Century** (3) Hitchcock
A reading knowledge of Italian is desirable for the Italian area and German for the northern area. (Spring)

*221 **Seminar: Renaissance Art** (3) Staff
A reading knowledge of French, German, or Italian is desirable, depending on the specific area. (Fall and spring)

*†243 **Seminar: American Art** (3) Grubar
(Fall and spring)

*†244 **Seminar: 19th-Century European Art** (3) Robinson
Reading knowledge of French desirable.

*†245 **Seminar: 20th-Century European Art** (3) Lader

*246 **Seminar: Classical Art** (3) Williams

*247 **Pro-Seminar: Medieval Art and Archaeology** (3) Anderson

248 **Independent Research in Art History** (3)
(Fall and spring)

*261 **Seminar: Problems in Art History** (3) Staff

271–72 **Museum Techniques** (3–3) Staff
Open only to candidates for the degree of Master of Arts in the fields of museum training and museum studies. Practical work to be determined by Museum Training Committees at the institutions involved. (Academic year)

284 **Seminar: Studies in American Art and History** (3) Staff
Joint offering of the Art Department and the American Studies Program in affiliation with the National Portrait Gallery of the Smithsonian Institution. Exploration of selected problems and themes in American cultural history involving the use of artistic materials in different media; emphasis on methodology and analytic techniques. (Spring)

289–90 **Thesis Research** (3–3) Staff
(Fall and spring)

* Specific area announced in the *Schedule of Classes*. May be repeated for credit if the specific area covered is different.
† Laboratory fee, $15 when course is taught off campus.

292 **Introduction to Conservation** (3) Rose
Interdepartmental course offered by the Art and Anthropology Departments. Method and theory of conservation, including fine arts, ethnographic, archeological, and monuments conservation; handling, restoration, preservation, storage, and display of museum specimens; basic materials of ethnographic objects and the ways they react to their environment. The fall section is open to conservation students and to those who plan to register for Art 293 in the spring. (Fall and spring)

293 **Preventive Conservation Techniques** (3) Rose
(Formerly Conservation Laboratory Techniques)
Interdepartmental course offered by the Art and Anthropology Departments. Practical aspects of preventive conservation such as monitoring environmental conditions with measuring and recording devices, examining objects and documenting their conditions (including photography); and identifying sources of deterioration for various materials. Students will conduct tests, evaluate exhibition and storage areas, and participate in improving and correcting museum conditions. Prerequisite: Anth/Art 292.

Fourth Group
Limited to art history doctoral candidates. Offered as the demand requires.

*385–86 **Readings in Art History** (3–3)

*398 **Advanced Reading and Research** (arr.)
For students preparing for the doctoral examination.

*399 **Dissertation Research** (arr.)

FINE ARTS

Departmental prerequisite: Art 21–22 and 41–42 (students concentrating in photography substitute Art 23 and 24 for 41–42).

First Group

21–22 **Design I: Basic** (3–3) Costigan, Teller
Required of all Fine Arts majors. Fundamental studies of principles and elements of design. Art 21: study of two-dimensional design. Art 22: three-dimensional studies. Art 21: Laboratory fee, $15. Art 22: Laboratory fee, $21. (Art 21 and 22—fall and spring)

23 **Introduction to Photography** (3) Lake and Staff
Introduction to the principles of exposure and development of films and papers. Emphasis on creative expression. Laboratory fee, $4[illegible] (Academic year)

24 **Fundamentals of Photography** (3) Lake and Staff
Film developers; types and effects on films. Emphasis on control for creative expression. Prerequisite: Art 23. Laboratory fee, $4[illegible] (Academic year)

41–42 **Drawing I** (3–3) Wright and Staff
Elementary investigation of concepts of drawing, both traditional and contemporary; training in perception, analysis of form in light and space; instruction in the use of graphic materials and media; exercises in connoisseurship. Material and model fee, $30 per semester. (Art 41 and 42—fall and spring)

51 **Introduction to Handbuilt Ceramics** (3) Ozdogan, L. Smith
Working with clay as an art form. Exploration of pinch, coil, slab, hump and press mold, paddling and hollowing techniques. Sketch

* May be repeated for credit.

studies, reduction and oxidation kiln-firings, clay and glaze making. Laboratory fee, $54.* (Fall and spring)

52 **Introduction to Wheelthrown Ceramics** (3) Ozdogan and Staff
Development of cylindrical and open forms. Trimming, clay and glaze making, reduction and oxidation kiln firings. Sketch studies. Laboratory fee, $54.* (Fall and spring)

57–58 **Graphics I** (3–3) Griffith, Wright
Exploration of the methods of intaglio, relief, printing, and other composite processes. Material fee, $21 per semester. (Academic year)

61–62 **Water Color** (3–3) Staff
Painting in transparent and opaque water color and in acrylic. Experimentation, figurative and landscape. (Academic year)

65–66 **Painting I** (3–3) A. Smith and Staff
Emphasis on personal expression with exposure to a variety of styles. Application of design principles to easel painting. Prerequisite: Art 21, 41. Material and model fee, $21 per semester. (Academic year)

81–82 **Sculpture I** (3–3) Gates and Staff
Three-dimensional design. Basic sculptural techniques; modeling, carving, and construction. Media include wood, clay, stone, plaster. Laboratory fee, $24 per semester. (Academic year)

Second Group

Second-group art courses may be repeated for credit with approval of the department.

123–24 **Individual Problems** (3–3) Staff
Emphasis on problems and materials of specific interest to the student in any area of Fine Arts. Laboratory fee depending on area chosen.† Prerequisite: permission of instructor. (Academic year)

125–26 **Painting II** (3–3) A. Smith
Alteration of personal expression and structured problems dealing with still-life and the figure. Use of acrylic and oil. Material and model fee, $21 per semester. (Academic year)

127–28 **Painting III** (3–3) Woodward
Studies in the interpretation of the figure and still-life. Emphasis on color, space, planes, modulations. Alla prima and mixed techniques. Material and model fee, $21 per semester. (Academic year)

131 **Intermediate Ceramics: Wheelthrown Functional Forms** (3) Ozdogan and Staff
Aesthetic and technical development of wheelthrown functional ceramic forms. Exploration of attachments: lids, spouts, handles, and footing devices. Sketches and technical drawings, clay and glaze-making tests, varied temperature firings in reduction and oxidation atmospheres. Laboratory fee, $54.* (Fall and spring)

132 **Intermediate Ceramics: Wheelthrown Non-functional Forms** (3) Ozdogan and Staff
Aesthetic and technical development of thrown ceramic sculptural forms. Emphasis on section throwing, closed forms, and construction. Varied temperature firings in oxidation and reduction atmospheres. Clay and glaze making. Laboratory fee, $54.* (Fall and spring)

133 **Ceramic Decoration** (3) Ozdogan
Aesthetic and technical development of surface decoration, with ex-

* Laboratory fee in all ceramics courses includes unlimited materials and tools.
† Schedule of Fees: Ceramics—$54; 2-D Design—none; 3-D Design—$24; Drawing—$30; Graphics—$24; Sculpture—$24; Typography—$30; Painting—none; Photography—$42; Visual Communication—$30.

perimental projects in sgraffito, mishima, engobe, majolica, underglaze, overglaze, and relief techniques. Laboratory fee, $54* (Fall)

134 **History of Photography** (3) Staff
(Spring)

135–36 **Advanced Water Color** (3–3)
Development of techniques of water color; concentration on special projects. (Academic year)

137 **Workshop in Materials, Methods, and Techniques** (3) Woodward, A. Smith, and Staff
Technical investigation of painting methods from the 14th century to the present. Preparation of grounds, media, underpainting, glazing. Laboratory fee, $15. (Fall and spring)

138 **Graphics: History and Practice** (3) Griffith
Laboratory fee, $21.

139 **Design in Fiber** (3) Costigan
Emphasis on individual expression in two- and three-dimensional fiber works, with exposure to a variety of styles, attitudes, and materials. Prerequisite: Art 21–22 or permission of instructor. Laboratory fee, $9.

141 **Interior Design I** (3) Teller
Survey of materials and techniques used in domestic dwellings. Emphasis on diagrams, floor plans, and effective use of materials. Lecture and studio problems. Laboratory fee, $21.

142 **Interior Design II** (3) Teller
Survey of furniture style as applied to drawingboard problems in creative interior design. Prerequisite: Art 141. Laboratory fee, $21.

143–44 **Serigraphy** (3–3) Teller
Fine Arts printmaking using serigraphic techniques. Utilization of all basic techniques; emphasis on aesthetic properties of prints. Prerequisite: Art 21 and 41–42. Laboratory fee, $21 per semester. (Academic year)

146 **Ceramic Restoration** (3) Ozdogan
Methods and techniques for museum and commercial application. Laboratory fee, $21. (Summer)

151 **Ceramic History and Technology** (3) Ozdogan and Staff
A survey of the history of ceramics and its technology. Lectures, demonstrations and supplemental programs. (Fall)

152 **Ceramic Sculpture** (3) Ozdogan, L. Smith
Developing an understanding of the sculptural ceramic form which integrates both quality and creativity. Techniques in hollow and solid construction. Varied temperature firings in reduction and oxidation kilns. Laboratory fee, $54.* (Fall)

153–54 **Graphics II** (3–3) Griffith, Wright
Advanced relief, intaglio, and other composite processes. Prerequisite: Art 57–58. Material fee, $21 per semester. (Academic year)

157–58 **Graphics III** (3–3) Griffith
Exploration of combined techniques and mixed media. Prerequisite: Art 153–54. Material fee, $21 per semester. (Academic year)

159–60 **Drawing II** (3–3) Wright and Staff
Study and application of master drawing techniques. Investigation of perspective and anatomy. Emphasis upon conceptual development of personal style. Prerequisite: Art 41–42. Material and model fee, $8 per semester. (Academic year)

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* Laboratory fee in all ceramics courses includes unlimited materials and tools.

163–64 **Visual Communication I** (3–3) Molina and Staff
Layouts and execution in client-presentation form of various graphic design projects—brochures, bookjackets, displays, title graphics for film media. Material fee, $21 per semester. (Academic year)

166 **Advanced Drawing Techniques** (3) A. Smith and Staff
Specific area announced in the *Schedule of Classes*. May be repeated for credit if the area covered is different. Prerequisite: Art 41–42. Laboratory fee, $21.

171 **Typography I** (3) Molina and Staff
Techniques of hand lettering, traditional and contemporary. Exploration of the decorative potential in lettering. Material fee, $21. (Fall)

172 **Typography II** (3) Molina
Study of type classification, recognition, and adaption. Methods of copy fitting and type reproduction processes. Typographic layout and specification. Material fee, $21. (Spring)

174 **Visual Communication II** (3) Molina
Limited to seniors. Material fee, $21.

175 **Lithography** (3) Staff
May be repeated for credit if the area covered is different. Material fee, $21.

177–78 **Survey of Printing and Illustration** (3–3) Staff
Exposure to a maximum range of illustrative processes, both practical and theoretical. Technical aspects of commercial printing processes; methods of preparation of artwork, photographs, and typographic proofs for commercial reproduction. (Academic year)

179–80 **Sculpture II** (3–3) Gates
Creation of three-dimensional forms using combination of techniques: wood, steel, plastic, and plaster. Prerequisite: Art 81–82. Laboratory fee, $24 per semester. (Academic year)

181 **Introduction to Color Photography** (3) Lake
Use of filters for creating and correcting color shifts with emphasis on color as subject matter. Prerequisite: Art 23 and 24 or permission of instructor. Laboratory fee, $42. (Fall)

182 **Intermediate Photography** (3) Lake
Filters and their use with black-and-white film as means of tone control. Emphasis on creative expression. Prerequisite: Art 23 and 24 or permission of instructor. Laboratory fee, $42. (Spring)

183 **Intermediate Black and White Photography** (3)
Emphasis on role of ideas in black and white photography. Critiques designed to encourage development of an individual style. Prerequisite: Art 23 and 24 or permission of instructor. Laboratory fee, $42. (Fall and spring)

185–86 **Portrait Painting and Drawing** (3–3) C. Smith
Fall: Various media; drawing and pastel. Spring: oil. Model fee, $21 per semester.

189–90 **Sculpture III** (3–3) Gates
Advanced study in concepts and materials through creation of three-dimensional forms concentrating on relevance of scale and media. Relationship of sculpture to the environment. Prerequisite: Art 179–80. Laboratory fee, $24 per semester. (Academic year)

193–94 **Film Making** (3–3) Kernan
Basic techniques and procedures for film making. Prerequisite: Art 23 and 24 or permission of instructor; Art 193 is prerequisite to Art 194. (Academic year)

195 **Documentary Photography** (3) Battaglia
Historical development of documentary photography. Completion of two projects required. Laboratory fee, $42. Prerequisite: Art 23 and 24 or permission of instructor. Same as Jour 195. (Fall)

197–98 **History of Photography** (3–3)
Discussion of major figures and movements in the history of photography.

Third Group
All third-group art courses may be repeated for credit with the approval of the department.

205 **Advanced Photography: Zone System Tests** (3) Lake
Tone control through exposure development tests. Completion of laboratory manual required. Prerequisite: Art 181 and 182 or permission of instructor. Laboratory fee, $42. (Fall and spring)

206 **Photography: Special Projects** (3) Lake and Staff
Prerequisite: Art 181 and 182 or permission of instructor. Laboratory fee, $42. May be repeated for credit.

208 **Advanced Photography** (3)
Advanced problems in photography; emphasis on individual development. Prerequisite: Art 181 and 182 or permission of instructor. Laboratory fee, $36. (Fall and spring)

209–10 **Exhibition and Display Design** (3–3) Miller

224 **Advanced Ceramic Sculpture** (3) Ozdogan
Continuation of Art 152 with emphasis on individual approach. Exploration of mixed media and mold casting. Laboratory fee, $54. (Fall)

225 **Advanced Ceramic Decoration** (3) Ozdogan, Smith
Perfection of decorating techniques. Students establish style through independent exploration. Laboratory fee, $54. (Spring)

226 **Architectural Ceramics** (3) Ozdogan
Advanced studies in ceramic murals and sculpture oriented toward indoor and outdoor architectural concepts. Laboratory tests and activities. Laboratory fee, $54. (Spring)

231–32 **Design III** (3–3) Gates
New media and techniques in three-dimensional design. Laboratory fee, $24 per semester. (Academic year)

234 **Design IV** (3) Staff
Specifications and fabrication of materials in three-dimensional presentation. (Fall and spring)

235 **Design V: Textile Printing** (3) Teller
Designing and executing textiles using the techniques of silk screen, block print, and batik. Laboratory fee, $21. (Fall and spring)

248 **Independent Research in Fine Arts** (3)
For master's degree candidates; open to limited number of qualified undergraduates, with permission. Independent research arranged in consultation with individual instructor and graduate advisor. May be repeated for credit. Laboratory fee depending on area chosen.* (Fall and spring)

249 **Theory of Design** (3) Costigan
Application of design principles to problems of the artist in all disciplines. Emphasis on individual creativity, presentation, and criticism.

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* *Schedule of Fees:* Ceramics—$54; 2-D Design—none; 3-D Design—$24; Drawing—$30; Graphics—$21; Sculpture—$24; Typography—$30; Painting—none; Photography—$42; Visual Communications—$30; Serigraphic Techniques—$21.

Guest lectures on issues in contemporary art. Open to all MFA candidates and to seniors with permission of instructor. Laboratory fee, $9.

251 **Advanced Ceramic Design in Wheel Throwing** (3) Ozdogan
Individual projects on the potter's wheel. Student establishes personal style and direction, and perfects skills. Either pottery or sculptural approaches encouraged. Research in clays, glazes, and firings is required. Laboratory fee, $54. (Fall and spring)

252 **Advanced Ceramic Design in Hand Building** (3) Ozdogan
Individual projects in hand building. Student establishes style and direction, and perfects skills. Either pottery or sculptural approaches encouraged. Research in clays and glazes is required. Laboratory fee, $54. (Fall and spring)

253 **Industrial Ceramic Design/Mold Making** (3) Ozdogan
Study in the multiple production process from model making to finished duplicate form as it exists on factory level. Methods include all aspects of model designing and making in clay and plaster; mold making in plaster; production methods from molds including press molding, slip-casting, jiggering, and jollying. Laboratory fee, $54. (Fall and spring)

254 **Ceramic Glazes: Calculation and Formulation** (3) Glassman
Laboratory fee, $21.

255–56 **Graphics IV: Advanced Serigraphy** (3–3) Teller
Utilization of principles and techniques of serigraphy toward development of personal statement and style. Prerequisite: Art 143–44. Laboratory fee, $21 per semester. (Academic year)

257–58 **Graphics V: Etching and Engraving** (3–3) Griffith
Prerequisite: Art 157–58. Material fee, $21 per semester. (Academic year)

259 **Graphics VI: Lithography** (3) Wright
Material fee, $21. (Fall and spring)

260 **Graphics VII: Relief Printing** (3) Griffith
Material fee, $21. (Fall and spring)

265–66 **Painting IV** (3–3) Woodward
Alternatives in pictorial dynamics. Assigned studio and independent problems in alla prima and mixed techniques. Material and model fee, $15 per semester. (Academic year)

267–68 **Individual Problems in Photography** (3–3) Lake and Staff
Limited to MFA candidates and qualified undergraduates. Prerequisite: Permission of instructor and approval of project prior to registration. May be repeated for credit. Laboratory fee, $42 per semester. (Academic year)

275 **Painting V** (3) Woodward
Development of personal imagery. Individual problems and critiques. Material and model fee, $15.

277–78 **Advanced Visual Communication** (3–3) Molina
Design and execution of graphic design projects, including magazine spreads, posters, advertisements, trademarks, letterheads, packages. Psychological and symbolic aspects of design solutions. Laboratory fee, $30 per semester. (Academic year)

279–80 **Sculpture IV** (3–3) Gates
Advanced study aimed at development of concept and style. Prerequisite: permission of instructor. Laboratory fee, $24. (Academic year)

281 **Sculpture V** (3) Gates
Emphasis on individual sculptural concepts and materials. Prerequisite: permission of instructor. Laboratory fee, $24. (Fall and spring)

299–300 **Thesis Research** (3–3) Staff
Laboratory fee depending on area chosen.* (Fall and spring)

ART THERAPY—GRADUATE PROGRAM

Professors B.I. Levy *(Program Director)*, D.E. Silber *(Associate Director)*
Adjunct Associate Professors E. Ulman *(Coordinator of Training)*, E. Kramer, J. Krash
Assistant Professors A.R. Bruhn *(Assistant Director)*, K.J. Williams
Adjunct Assistant Professors W. Maiorana, M. Fleming, P.A. Rossiter-Ravenscroft
Lecturer A.J. Evans
Clinical Instructors S. Fishman, M.S. Schmal, P. Howie, D.K. Conger, K.J. Datel, B.K. Mandel, N.J. Schoebel, K.M. Jensch

Master of Arts in the field of art therapy—Prerequisite: a bachelor's degree, evidence of significant training and/or experience in art, including painting, drawing, and clay modeling; course work in the behavioral and/or social sciences, including personality theory, abnormal psychology, and child psychology.

Required: the general requirements, pages 89–96. Prospective candidates should consult the brochure which describes the program for specific requirements.

Fields of emphasis: adult art therapy, family art therapy, child art therapy, and research.

201 **Introduction to Art Therapy** (3) Ulman
Lectures, presentation of illustrative case material, class discussion of assigned readings, field work. Survey covering range of art therapy practice, personality assessment and treatment approaches, historical development, main theoretical trends. Open only to art therapy degree candidates. (Fall)

202 **Case Studies in Art Therapy** (3) Ulman
Discussion of case material provided by students in order to refine methods of working, improve written and oral reports. Instructor and other practitioners may provide supplementary illustrative material. Assigned reading. Prerequisite: ArTh 201, 203; open to others with permission of instructor. (Spring)

203 **Technique of Art Therapy** (3) Williams
Art therapy approaches with individuals and groups of different diagnostic categories in various settings presented through illustrative clinical examples. Students experiment with numerous techniques through the use of art materials. Open only to art therapy degree candidates. (Fall)

204 **The Freudian Model in Art Therapy** (3) Kramer, Ulman
Concepts of instinctual drives; ego development; mechanisms of defense; sublimation; transference and countertransference; maturation and regression applied to work with children, adults, families, and groups. (Fall)

205–6 **Family Art Techniques** (3–3) Rossiter-Ravenscroft
Principles of work with families, with emphasis on the use of art techniques for evaluation of family dynamics. The major focus is on opportunities to conduct and observe family art evaluations. Enroll-

* *Schedule of Fees:* Ceramics—$54; 2-D Design—none; 3-D Design—$24; Drawing—$30; Graphics—$21; Sculpture—$24; Typography—$30; Painting—none; Photography—$42; Visual Communications $30; Serigraphy—$21.

ment is limited to 12. Prerequisite: ArTh 201, 203. Open to art therapy degree candidates only. (Fall and spring)

207 **Art as Therapy with Children** (3) Maiorana
Introduction to the practical and theoretical considerations involved in art as therapy with children. Focus on psychodynamics, artistic developmental stages, methods of child art evaluation, and basic issues in therapeutic guidance of the child. Prerequisite: ArTh 201, 203; open to others with permission of instructor. (Fall)

208 **Art Therapy with Adolescents** (3) Fleming
Theoretical and practical issues in art therapy with adolescents in educational and clinical settings. Experiential work in art techniques appropriate to this population. Class discussion of readings on adolescent development. Prerequisite: ArTh 201, 203; open to others with permission of instructor. (Spring)

211 **Survey of Art Therapy** (3) Maiorana, Williams, Evans
Use of visual arts to enhance personal development; history, theories, range of practice in art therapy. Illustrated lectures, reading, discussion, studio work. Not intended for art therapy degree candidates. Open to advanced undergraduates with permission of instructor. (Fall and spring)

218 **Seminar: Systems of Psychotherapy** (3) Silber
Introduction to theory and technique of psychotherapeutic approaches: psychoanalytic, ego-centered, nondirective, transactional, and others. Original sources surveyed. Prerequisite: ArTh 201 and 203, or 211, or permission of instructor.

220 **Process of Art Therapy** (6) Maiorana, Williams
Exploration of the treatment process. Students discuss literature from art therapy and related fields and rehearse fundamental ways of being an art therapist through videotaped role-playing. Designed to increase students' ability to evaluate their own therapeutic effectiveness. Prerequisites: ArTh 201, 203; open to others with permission of instructor. (Spring)

275 **Group Art Therapy** (3) Williams
Experience as participant, observer, and leader in an art-centered group; required reading; theory of group process. Open to art therapy master's degree candidates and others with permission of instructor. (Summer)

283–84 **Practicum in Art Therapy** (3–3) Staff
Minimum of 300 hours field work per semester connected with service to clients. On-the-job supervision supplemented by group supervision from the art therapy staff. Prerequisite: ArTh 201 and 203. Open only to art therapy degree candidates.

285 **Special Projects in Art Therapy** (3) Staff
Individual work based on study, research, or practice. Details to be worked out with each student. Resource people may be called upon to assist, as appropriate. May be repeated for credit with approval of advisor.

289 **Special Topics in Art Therapy** (3) Staff
Connections between art therapy and other disciplines; new developments in the field. May be repeated for credit with approval of advisor. Open to art therapy degree candidates and others with permission of instructor.

290 **Workshops in Art Therapy** (3) Staff
Art therapists and other mental health professionals will conduct four weekend workshops during the semester. Emphasis on the

elucidation of concepts of treatment through lectures, discussion, and participation. (Spring)

ASTRONOMY

See **Physics.**

BIOCHEMISTRY—GRADUATE PROGRAMS

Professors B.W. Smith, G.V. Vahouny, J.M. Bailey, A.L. Goldstein *(Chairman)*, C.R. Treadwell *(Emeritus)*
Associate Professors G.A. Walker, L.L. Gallo, A. Kumar
Assistant Professor T. Moody

Master of Science in the field of biochemistry—Prerequisite: a bachelor's degree. The undergraduate program must have included the following courses, or equivalent: BiSc 11-12; Chem 11-12, 22, 151-52, 153-54; Phys 1, 2.

Required: the general requirements, pages 89–96, including Bioc 221–22, 225–26, 229, 299–300; Chem 251. The remaining courses are to be selected from Bioc 231, 232, 240, 250, 260, 270. It is expected that students will complete all of the required work in approximately two years.

Doctor of Philosophy in the field of biochemistry—Required: the general requirements, pages 89–91, 96–99.

Research fields: endocrinology—thymosin, steroid hormones, prostaglandins; immunology—immuno-chemistry, thymosin peptides; molecular biology—RNA metabolism, protein synthesis, gene transfer; lipid chemistry and metabolism—essential fatty acids, lipoproteins, complex lipids, cholesterol, peroxides, atherosclerosis, steroidogenesis; nutrition—dietary fiber, dietary fat, trace minerals neurochemistry—endorphins, enkephalins, nerve growth factors, bombesis; protein chemistry; B_{12} coenzymology.

221-22 **General Biochemistry** (3–4) Gallo and Staff
A comprehensive course in general biochemistry for graduate students in biomedical sciences and undergraduate students in biology and chemistry. Prerequisite: Chem 152, 154. (Academic year)

225–26 **Introduction to Biochemical Research** (arr.) Smith and Staff
Rotation through research projects in laboratory units within the Biochemistry Department to provide individualized in-depth training in the methods and instrumentation used in those units. Limited to students in the Department of Biochemistry graduate program. (Academic year)

227 **Biochemistry Seminar** (1) Bryant*
Current literature in biochemistry. Open to graduate students in the biomedical sciences and to a limited number of medical students. May be repeated for credit. (Fall and spring)

229 **Biochemistry of Enzymes** (2) E. Anderson†
Content includes practical handling of enzymes, kinetics, reaction mechanisms, active site, isozymes, regulation, and other special topics. Prerequisite: Bioc 201 or 221. (Spring)

230 **Current Topics in Enzymology** (2) Bailey and Staff
Directed readings in various areas of enzymology. May be repeated

* Robert Wesley Bryant is Assistant Research Professor of Biochemistry in the G.W.U. School of Medicine and Health Sciences.
† Elizabeth Potts Anderson is Professorial Lecturer in Biochemistry in the G.W.U. School of Medicine and Health Sciences.

for credit. Enrollment limited to graduate students in biochemistry. Prerequisite: Bioc 229.

231 Bioenergetics (2) Staff
Content includes laws of thermodynamics, application of these laws to biological systems; oxidation–reduction processes and other special topics. Prerequisite: Bioc 221–22. (Fall)

232 Protein Chemistry (2) Steers* and Schechter†
Content includes the theory and methods of protein chemistry, the structure-function relationship of proteins and other special topics. Prerequisite: Bioc 201 or 221. (Fall)

240 Nutrition (2) Walker and Staff
Content includes discussion of RDA, nitrogen-balance, vitamins and minerals, diets and other special topics. Prerequisite: Bioc 201 or 221–22. (Spring)

241 Current Topics in Nutrition (2) Walker and Staff
Directed readings in various areas of nutrition. May be repeated for credit. Enrollment limited to graduate students in biochemistry. Prerequisite: Bioc 240.

250 Cell and Molecular Biology (3) Kumar and Staff
Content includes the organization and replication of genetic material, transcriptional and translational machinery, regulation of eukaryotic gene expression and other special topics. Prerequisite: Bioc 201 or 221–22. (Fall)

251 Current Topics in Molecular Biology (2) Kumar and Staff
Directed readings in the area of molecular biology. May be repeated for credit. Enrollment limited to graduate students in biochemistry. Prerequisite: Bioc 250.

252 Biochemical and Molecular Aspects of Selected Diseases (2) Irwin‡ and Staff
Emphasis on the biochemical and molecular aspects of selected major diseases. The format will be of a tutorial type, including presentations of material by students. (Spring)

256 Biochemical Genetics and Inherited Metabolic Diseases (1 or 2) Merril
Biochemical aspects of genetics and contributions of molecular biology to understanding of human mutations and hereditary diseases. Prerequisite: Bioc 250. (Spring)

260 Lipids (2) Gallo and Vanderhoek§
Content includes the biosynthesis, metabolism, and functions of lipoproteins, prostaglandins, and other special topics. Prerequisite: Bioc 221–22. (Spring)

261 Current Topics in Lipids (2) Vahouny and Staff
Directed readings in the area of lipid biochemistry. May be repeated for credit. Enrollment limited to graduate students in biochemistry. Prerequisite: Bioc 260.

263 Steroids (2) Dodek§§
For medical students; open to a limited number of graduate students.

* Edward Steers, Jr., is Professorial Lecturer in Biochemistry in the G.W.U. School of Medicine and Health Sciences.
† Allen Neil Schechter is Professorial Lecturer in Biochemistry in the G.W.U. School of Medicine and Health Sciences.
‡ Richard Irwin is Assistant Research Professor of Biochemistry in the G.W.U. School of Medicine and Health Sciences.
§ Yehudi Vanderhoek is Assistant Research Professor of Biochemistry in the G.W.U. School of Medicine and Health Sciences.
§§ Professor Irving Dodek, Jr., is Clinical Professor of Biochemistry in the G.W.U. School of Medicine and Health Sciences.

Content includes chemistry of steroid pathways of biosynthesis and metabolism, clinical manifestations of steroid unbalance, steroid changes in pregnancy and other special topics. Prerequisite: Bioc 201 or 221–22. (Spring)

264 **Membrane-Associated Complex Lipids** (1) Fishman*
Topics will cover the catabolism and biosynthesis of complex sphingolipids; inherited metabolic diseases associated with abnormal sphingolipid metabolism; membrane receptors for hormones and toxins; and other special topics. Prerequisite: Bioc 221–22. (Spring)

270 **Biochemistry and Cell Biology of the Immune Response** (2) Zatzt and Staff
Biochemical aspects of the immune response at the molecular and cellular level. Modern experimental approaches to immunology and cell biology. Prerequisite: Bioc 221–22 and Micr 229, or permission of instructor. (Spring)

271 **Current Topics in Immunology** (2) Goldstein and Staff
Directed readings in the area of biochemical immunology. May be repeated for credit. Enrollment limited to graduate students in biochemistry. Prerequisite: Bioc 270.

280 **Biochemistry of Nerve Tissue** (2) Staff
Content includes molecular structure and function of nerve tissue, intra- and inter-neuronal communication mechanisms; biochemistry of various brain dysfunctions; and other special topics. Prerequisite: Bioc 201 or 221–22. (Fall)

295 **Research in Biochemistry** (arr.) Staff
Participation in a project under investigation in the department or one in a related field suggested by the student and approved by the staff. Content differs each time course is offered; may be repeated for credit. (Fall and spring)

299–300 **Thesis Research** (3–3) Staff
(Fall and spring)

398 **Advanced Reading and Research** (arr.) Staff
Limited to students preparing for the Doctor of Philosophy general examination. May be repeated for credit. (Fall and spring)

399 **Dissertation Research** (arr.)
Limited to Doctor of Philosophy candidates. May be repeated for credit. (Fall and spring)

BIOLOGICAL SCIENCES

Professors R.L. Weintraub *(Emeritus)*, K.F. Parker *(Emeritus)*, S.O. Schiff *(Chairman)*, D.L. Atkins, R.K. Packer

Adjunct Professors T.E. Bowman, M.L. Jones, L.S. Kornicker, H.A. Rehder, F.A. Chace, Jr., R. Manning, C.G. McWright

Professorial Lecturers W.A. Shropshire, Jr., J.C. Petricciani, C.F. Cleland, R.W. Read, H. Hoffman

Associate Professors R.E. Knowlton, H. Merchant, T.L. Hufford

Adjunct Associate Professors W.D. Hope, D.L. Pawson, J. Rosewater, G.F. Roper, M. Rice

* Peter Harvey Fishman is Professorial Lecturer in Biochemistry in the G.W.U. School of Medicine and Health Sciences.

† Marion M. Zatz is Adjunct Associate Professor of Biochemistry in the G.W.U. School of Medicine and Health Sciences.

Associate Professorial Lecturers P.E. Spiegler, J.C.C. Dickens, B.M. Timberlake, D.A.P. Houston, R.P. Eckerlin
Assistant Professors D.E. Johnson, R. Donaldson, J.R. Burns, E.F. Wells, K.M. Brown

Bachelor of Arts or Bachelor of Science with a major in biology, botany, or zoology (departmental)—The following requirements must be fulfilled:

1. The general requirements as stated on pages 71–72, 79–85. (Students should consult the departmental advisor regarding courses to be taken in satisfying the requirement for meaningful initiation into the social sciences and the humanities.)

2. Prerequisite courses—BiSc 11–12, or equivalent.

3. **Required courses in related areas—Chem 11–12; Chem 151–52 and 153–54, or 50.** (The following courses are strongly recommended: Math 31; Phys 1, 2; two years of French, German, or Russian; Stat 91 or 127.)

4. (a) Required courses for the major in biology—a minimum of 24 semester hours of second-group courses, which should include at least six hours in biology, six in botany, and six in zoology. In fulfillment of the botany requirements, students may take either BiSc 133 or 137, but not both.

(b) Required courses for the major in botany—a minimum of 24 semester hours of second-group courses; a minimum of 12 hours must be taken in botany, and no more than one zoology course may be included. In fulfillment of the botany requirements, students may take either BiSc 133 or 137, but not both.

(c) Required courses for the major in zoology—a minimum of 24 semester hours of second-group courses; a minimum of 12 hours must be taken in zoology, and no more than one botany course may be included.

5. **The Bachelor of Science** degree requires two semesters of introductory physics with lab in addition to the requirements listed above.

Special Honors—In addition to the general requirements (page 50), in order to be considered for graduation with special honors, a student must attain grades of *A* or *B* in half of all courses taken in the biological sciences and in all other science courses required for the major.

Minor in biology—12 semester hours of second-group courses,* which must include at least 3 hours in biology, 3 in botany, and 3 in zoology.

Minor in botany—12 semester hours of second-group courses,* of which 8 hours must be in botany.

Minor in zoology—12 semester hours of second-group courses,* of which 8 hours must be in zoology.

Master of Science in the field of biology, botany, or zoology—Prerequisite: a bachelor's degree with a major in one of the following from this University, or the equivalent degree: (1) *Biology field*—an undergraduate major in biology, botany or zoology; (2) *Botany field*—an undergraduate major in botany or zoology; (3) *Zoology field*—an undergraduate major in zoology or biology. The undergraduate program must have included the following courses, or equivalent: Chem 151–52 and 153–54, or 50; Math 31; Phys 1, 2.

Required: the general requirements, pages 89–96. The minimum requirement consists of 24 semester hours of approved course work plus a thesis (equivalent to six semester hours). With the permission of the department a student may elect a program of study consisting of 36 semester hours of approved course work without a thesis.

Master of Arts in the field of museum studies, with specialization in the biological sciences, see pages 384–86.

* BiSc 171 through 178 do not count toward fulfillment of the 12-hour second-group course requirements.

Doctor of Philosophy in the field of biology, botany or zoology—Required the general requirements, pages 89–91, 96–99, plus satisfactory completion of a Preliminary Examination and the General Examination in four areas of biology. The program of study, fields of study, and tool subjects are determined in consultation with an advisory committee appointed for each candidate.

Research fields in biology: cell physiology, cytogenetics, developmental genetics, and molecular genetics.

Research fields in botany: photobiology, phycology, plant ecology, plant physiology (microorganisms), plant physiology (vascular plants), and taxonomy.

Research fields in zoology: animal ecology, bioenergetics; comparative neuroanatomy; comparative physiology; herpetology; histophysiology; invertebrate zoology; marine biology; radiation biology; taxonomy, anatomy and physiology of mollusks; vertebrate anatomy and taxonomy; vertebrate embryology and morphogenesis; vertebrate ichthyology; and vertebrate physiology.

Master of Science and *Doctor of Philosophy in the field of geobiology*, see pages 315–17.

Bachelor of Arts in Education and Human Development with a teaching field in biology—Interested students should contact the Office of the Dean of the School of Education and Human Development.

Departmental prerequisite: BiSc 11–12 or equivalent is prerequisite to all second-group courses in biology, botany and zoology, except by permission of the instructor.

BIOLOGY

First Group

Schiff

3–4 **Introductory Biology for Nonscience Majors** (3–3)
Lecture (2 hours), laboratory (2 hours). Survey of biological principles; emphasis on man as a functional organism in the environment. Prerequisite to BiSc 4: BiSc 3. Material fee, $18 per semester. (Academic year)

11–12 **Introductory Biology for Science Majors** (4–4) Hufford, Merchant
Lecture (3 hours), laboratory (3 hours). BiSc 11: Biological concepts and principles are demonstrated through consideration of the plant as an organism. BiSc 12: Beginning principles of inheritance, development, behavior, physiology, systematics, and evolution, using animals as the subject of investigation; designed to furnish a base for advanced studies in biology and related sciences. Prerequisite to BiSc 12: BiSc 11. Material fee, $24 per semester. (Academic year)

Second Group

Knowlton

103 **Marine Biology** (4)
Lecture (2 hours), laboratory and field (3 hours), plus some extended field trips. Study of relationships between organisms and physical, chemical, and biological factors of the marine environment. Consideration of the open ocean and coastal eco-systems and man's influence on them. Recommended prerequisite: BiSc 101 or 102, 130, 140. Material fee, $24. (Spring)

Merchant

107 **Field Biology** (4)
Field study of altitudinal zonation, species hybridization, territoriality, energy balance, time and energy budgeting, effects of exposure, and effects of introduction of alien species on flora and fauna in Great Smoky Mountains National Park. (Summer, odd years)

108 Organic Evolution (3) Staff
Synthetic theory of organic evolution including treatment of speciation, adaptive radiation, biogeography, population biology, sociality, and human evolution. (Spring)

111 Introductory Microbiology (4) Staff
Lecture (2 hours), laboratory (4 hours). Survey of the major groups of microorganisms with emphasis on structure, physiology, ecology, phylogenetic relationships, and economic importance. Prerequisite: one year of chemistry. Material fee, $24. (Fall and spring)

122 Cell Biology (3) Donaldson
Structure and function of biological molecules, viruses, and cellular organelles. Prerequisite: one semester of organic chemistry. (Spring)

123 Cell Biochemistry (3) Donaldson
Introduction to the metabolism of generalized cells of animals, plants, and microorganisms, including energetics, enzymes, respiration, biosyntheses, and regulatory mechanisms. Prerequisite: one semester of organic chemistry. (Fall)

124 Cell Biochemistry Laboratory (2) Donaldson
Designed to illustrate some of the principles and techniques of biochemical experimentation. Prerequisite or concurrent registration: BiSc 123. Material fee, $24. (Fall)

127 Genetics (3) Johnson
Introductory course. Basic aspects of transmission of genetic traits with particular reference to the chemical basis of heredity and gene action. (Fall and spring)

128 Genetics Laboratory (1) Johnson
Study of genetic principles using Drosophila, *E. coli*, and lambda phage. Prerequisite or concurrent registration: BiSc 127. Material fee, $24. (Fall and spring)

130 Advanced Genetics (3) Johnson
Emphasis on the use of genetic analysis in solving modern biological problems. Prerequisite: introductory course in genetics. (Spring)

140 General Ecology (4) Merchant
Lecture (3 hours), laboratory and field (3 hours). Introduction to the concepts of limiting factors, biogeochemical cycles, trophic levels, and energy transfer, and their relationship to the structure and function of population, species, communities, and ecosystems. Material fee, $24. (Fall)

144 Aquatic Ecology (4) Merchant
Lecture (3 hours), laboratory and field (3 hours). Principles applied to aquatic systems with special references to physiochemical properties, typical habitats and communities. Laboratory fee, $24. (Spring, odd years)

167 Radiation Biology (3) Schiff
Chemical, physical, and biological aspects of radiation; effects of radiation on cells and organisms, with emphasis on mammals; genetic effects. Recommended: two years of biological sciences, and chemistry or physics. (Fall)

168 Tropical Marine Biology (4) Knowlton, Packer
Study of relationships between organisms and physical, chemical, and biological factors in a tropical marine-estuarine environment, conducted through ecological field work in characteristic tropical ecosystems on the island of San Salvador, Bahamas. Laboratory

investigations on organism physiology. Recommended: BiSc 103 and or 163. Material fee, $40. (Summer, even years) Staff

171 **Undergraduate Research** (arr.)
Admission by permission of the staff member concerned. May be repeated for credit. Prerequisite: Chem 50 or 152; 16 semester hours in Biological Science courses. Material fee, $20 per semester hour. (Fall and spring) Staff

172 **Independent Study in Cell and Molecular Biology** (2)
Prescribed reading list and consultations with staff advisor culminating in a written report and/or examination. Prerequisite: permission of instructor. (Fall and spring) Staff

173 **Independent Study in Developmental Biology** (2)
Prescribed reading list and consultations with staff advisor culminating in a written report and/or examination. Prerequisite: permission of instructor. (Fall and spring) Staff

174 **Independent Study in Organismic Biology** (2)
Prescribed reading list and consultations with staff advisor culminating in a written report and/or examination. Prerequisite: permission of instructor. (Fall and spring) Staff

175 **Independent Study in Genetic and Evolutionary Biology** (2)
Prescribed reading list and consultations with staff advisor culminating in a written report and/or examination. Prerequisite: permission of instructor. (Fall and spring) Staff

176 **Independent Study in Environmental Biology** (2)
Prescribed reading list and consultations with staff advisor culminating in a written report and/or examination. Prerequisite: permission of instructor. (Fall and spring) Staff

185 **Human Nutrition** (3)
Dietary requirements and their underlying physiological and biochemical bases; composition of natural and modified foodstuffs and additives; social and economic aspects of nutrition. (Fall) Donaldson

Third Group

201–2 **Interdisciplinary Science** (4–4)
Joint offering of the Departments of Biological Sciences, Chemistry and Physics. A treatment of scientific methodology and knowledge, both principles and facts. Designed to provide a basic understanding of the natural sciences and of the nature of science itself. Overview of the known fundamental principles developed in scientific observation of the physical universe. Fundamental principles are applied to systems of increasing complexity, with emphasis on physical, chemical, and biological systems. Students enrolled in natural science programs may not take this course for credit. Prerequisite: high school algebra or equivalent. Levy, Merchant, Parke

206 **Seminar: Radiation Biology** (3)
Actions of radiation at subcellular, cellular, and organismal levels; factors modifying radiation damage; practical considerations in radiation exposure. Prerequisite: BiSc 167 or equivalent. (Spring) Shropshire

208 **Bioenergetics** (3)
Study of energy fixation and transfer in ecosystems and of their role in behavior, evolution, population dynamics, and species interactions. Prerequisite: BiSc 140 or equivalent. (Fall, odd years) Merchant

209 **Seminar: Principles and Mechanisms of Organic Evolution** (3)
Principles and mechanisms of evolution in animals and plants; popu- Staff

lation phenomena, speciation, and evolution above the species level. (Fall, even years)

220 **Seminar: Cell or Plant Biochemistry** (3) Donaldson
Course content changes each session, alternating between selected topics in cell biochemistry and plant biochemistry. May be repeated for credit. (Spring, even years)

227 **Seminar: Genetics** (3) Johnson
Current problems in genetics. Students are required to present one seminar covering the full class period. May be repeated for credit. (Fall, odd years)

228 **Population Genetics** (3) Johnson
Consequences of Mendelian inheritance on the population level as exemplified by gene frequencies, random mating, inbreeding, differential fertility and mutations. (Fall, even years)

229 **Cytogenetics** (3) Staff
Behavior of chromosomes in mitosis and meiosis as a basis for the transmission of genes from one generation to the next through reproduction and the influence of cytogenetic processes on the mechanisms of evolution. (Fall)

230 **Human Genetics** (3) Staff
Genetic mechanisms of transmission and expression of human traits, with emphasis on biochemical and cytogenetic aspects. Prerequisite: BiSc 127 or equivalent; previous course work in cell biology or cell biochemistry strongly recommended. (Spring)

243 **Seminar: Ecology** (3) Merchant
In-depth study of selected topics, including reports on original publications. May be repeated for credit. Prerequisite: BiSc 140 or equivalent. (Spring, even years)

248 **Analysis of Development** (3) Brown
Survey of current research in experimental morphology, developmental genetics, biochemical development, and developmental endocrinology. Prerequisite: BiSc 146 or equivalent. (Fall)

249 **Seminar: Developmental Biology** (3) Brown
Discussion and reports on current literature in developmental biology, with emphasis on developmental genetics. Prerequisite: at least one course each in developmental biology and genetics. (Spring)

272 **Electron Microscopy** (3) Atkins, Donaldson
Theory and practice of scanning and transmission electron microscopy, including specimen preparation, photography, and analysis of ultrastructural observations. Material fee, $40. (Spring)

295 **Research** (arr.) Staff
Investigation of special problems. May be repeated for credit. (Fall and spring)

299–300 **Thesis Research** (3–3) Staff
(Fall and spring)

Fourth Group (Applicable to Biology, Botany, and Zoology)

398 **Advanced Reading and Research** (arr.) Staff
Limited to students preparing for the Doctor of Philosophy general examination. May be repeated for credit. (Fall and spring)

399 **Dissertation Research** (arr.) Staff
Limited to Doctor of Philosophy candidates. May be repeated for credit. (Fall and spring)

BOTANY

Second Group

105 **Field Biology of Woody Plants** (4) — Wells
Lecture (2 hours), laboratory and field (4 hours). Field and laboratory studies on local and cultivated woody flora. Material fee, $20. (Fall)

106 **Field Botany—Lower Plants** (4) — Hufford
Lecture (2 hours), laboratory and field (4 hours). Primarily for non-specialists, emphasizing algae, mosses, and ferns. Material fee, $18. (Alternate summers)

109 **Developmental Plant Anatomy** (4) — Hufford
Demonstration, observation, discussion (6 hours). Initiation and ontogeny of tissues and organs of vascular plants. Material fee, $20. (Spring)

110 **Comparative Plant Morphology** (4) — Hufford
Demonstration, observation, discussion (6 hours). Evolutionary morphology and life histories as a basis for a phylogenetic study and the critical roles plants have in human welfare. Material fee, $20. (Fall, even years)

125 **Flowering Plants** (4) — Wells
Lecture (2 hours), laboratory and field (4 hours). Origin, evolutionary development, and principles of systematics of flowering plants. Material fee, $20. (Spring)

133 **Economic and Etho-botany** (3) — Hufford
A study of the importance of plants to humans: consideration of plants in folklore, in religion, in commerce, and as food. Narcotic, medicinal, and poisonous aspects of plants will be discussed. Material fee, $18. (Spring)

135 **Plant Physiology** (4) — Donaldson
Lecture (2 hours), laboratory (4 hours). Physiology of seed plants with emphasis on growth, development, tropisms, and reproduction. Prerequisite: Chem 11–12. Recommended: Chem 50 or 151–52. Material fee, $24. (Spring, odd years)

137 **Horticulture** (4) — Read, Houston
Lecture (2 hours), laboratory (4 hours). Basic principles of growth, propagation, and care of ornamental plants. Material fee, $20. (Fall and spring)

141 **Plant Ecology** (4) — Wells
Lecture (2 hours), laboratory (4 hours). Several Saturday and weekend field trips required. Material fee, $18. (Fall)

149 **Freshwater Algae** (4) — Hufford
Observation and discussion (6 hours). Systematics, morphology, physiology, and water quality interrelationships of freshwater algae. Field experience, including at least one weekend field trip. Material fee, $18. (Fall, odd years)

Third Group

221 **Seminar: Systematics of Flowering Plants** (3) — Wells
Review of current work in various disciplines of systematic research; topics of special interest to participants. May be repeated for credit. (Spring, odd years)

238 **Seminar: Current Topics in Phycology** (3) — Hufford
(Spring, odd years)

242 **Seminar: Plant Ecology** (3) — Wells
(Spring, even years)

289–300 Thesis Research (3–3) Staff
(Fall and spring)

ZOOLOGY

Second Group

101 Invertebrate Zoology (4) Knowlton
Lecture (2 hours), laboratory (4 hours). General survey of invertebrate animals, including classification, morphology, physiology, embryology, and evolutionary relationships among phyla. Material fee, $24. (Fall)

102 Advanced Invertebrate Zoology (4) Knowlton
Lecture (2 hours), laboratory and field (4 hours). Study of invertebrate systems (cells, tissues, organs, organisms), with emphasis on functional aspects (physiology and ecology) and taxonomy of important groups. Prerequisite: BiSc 101 or equivalent. Material fee, $24. (Spring, odd years)

104 Comparative Vertebrate Anatomy (4) Atkins
Lecture (2 hours), laboratory (4 hours). Evolution and comparative morphology of chordata, stressing recent forms. Material fee, $24. (Fall and spring)

120 Animal Behavior (3) Staff
Principles of animal behavior, including mechanisms and manifestations from simple reflex systems to social interaction. (Spring, even years)

143 Animal Ecology (4) Merchant
Lecture (3 hours), laboratory and field (3 hours). Application of ecological principles to the understanding and manipulation of animal populations. Prerequisite: BiSc 140 or permission of instructor. Laboratory fee, $24. (Spring, even years)

145 Introduction to Vertebrate Embryology (4) Brown
Lecture (2 hours), laboratory (4 hours). Origin and early development of the individual, formation of organ systems. Emphasis on frog, chick, and pig, with reference to human embryo. Material fee, $24. (Fall; spring, odd years)

146 Experimental Developmental Biology (4) Brown
Lecture (2 hours), laboratory (4 hours). Introduction to the experimental, biochemical, and genetic analysis of developing systems through examination of the literature and laboratory experiments. Prerequisite: BiSc 145 or equivalent, or permission of instructor. Recommended: a course in cell biology or genetics and Chem 50 or 151–52. Laboratory fee, $24. (Spring, odd years)

148 Histology (4) Burns
Lecture (2 hours), laboratory (4 hours). Introduction to microscopical anatomy of normal tissues and organs with emphasis on the interrelationship of structure and function. Material fee, $24. (Spring; fall, odd years)

153 Survey of Neurobiology (4) Atkins
Lecture (3 hours), laboratory (2 hours). Study of the gross and cellular anatomy, physiology, and biochemistry of the nervous system; emphasis on mammals. Prerequisite: BiSc 104. Material fee, $24. (Fall)

155 Parasitology (4) Eckerlin
Lecture (2 hours), laboratory (4 hours). Introduction to animal parasitology; survey of parasitic types from protozoa through arthropods. Material fee, $20. (Fall)

156 **Ichthyology** (4) Burns
General biology of fishes, including structure, function, distribution and evolution, with emphasis on adaptations. Prerequisite: background in comparative anatomy and vertebrate zoology, or permission of instructor. Lecture (3 hours), laboratory (2 hours). Material fee, $20. (Fall, even years)

157 **Comparative Endocrinology** (4) Burns
Lecture (3 hours), laboratory (2 hours). Comparative study of basic principles of chemical integration, neuro-endocrine relationships, and mechanisms of hormone action. Prerequisite: BiSc 104, 165 and/or concurrent registration in Chem 151–52 or Chem 50. Material fee, $24. (Fall)

161 **Entomology** (4) Staff
Lecture (2 hours), laboratory (4 hours). The biology of insects, including their morphology, physiology, development, behavior, and ecology. Material fee, $20. (Fall)

162 **Insect Population and Evolutionary Biology** (4) Staff
Lecture (3 hours), laboratory (3 hours). Study of the interactions of insects with other organisms and the effects these interactions have on insect evolution. Insects as disease vectors and as pollinators, and mimetic systems will be discussed. Prerequisite: BiSc 108, 140, or 161, or permission of instructor. Material fee, $20. (Spring, even years)

163 **Human Physiology** (3) Packer
Introduction to the function of organ systems of the human body. (Fall)

164 **Human Physiology Laboratory** (1) Packer
Study of basic physiology laboratory techniques; emphasis on the experimental study of homeostatic mechanisms in humans. Prerequisite or concurrent registration: BiSc 163, Material fee, $28. (Fall)

165 **Vertebrate Physiology** (4) Packer
Lecture (3 hours), laboratory (3 hours). Detailed study of selected organ systems, stressing chemical and physical bases. Prerequisite: BiSc 163 and 164, or equivalent. Prerequisite or concurrent registration: Chem 151–52 or 50. Material fee, $28. (Spring)

Third Group

204 **Seminar: Invertebrate Zoology** (3) Knowlton
Review of selected topics in physiology, development, and ecology of invertebrate animals, including reports on original publications. May be repeated for credit. (Fall)

211 **Adaptation and Natural Selection** (3) Staff
An examination of special evolutionary problems and conflicts as well as peculiar adaptive characters of certain species. These include the evolutionary basis of sociality, sex, maleness and femaleness, and the conflict between individual and population survival. Prerequisite: BiSc 108 or permission of instructor. (Spring, odd years)

212 **Seminar in Comparative Reproductive Biology** (3) Burns
Review of selected topics in animal reproduction, including neuro-endocrine regulation, reproductive cycles and behavior, and gonadal pathology. (Spring)

252 **Seminar: Neurobiology** (3) Atkins
Study of current publications in comparative neurobiology. May be repeated for credit with instructor's permission. (Spring, even years)

253 Evolution of the Nervous System (4) Atkins
Invertebrate and vertebrate nervous systems. The development of increasing complexity in neurons and systems of neurons, and the establishment of alternate pathways to accomplish particular functions. Lecture and laboratory. Prerequisite: BiSc 153. Material fee, $24. (Spring, odd years)

256 Fish Physiology (3) Packer
A survey of major organ systems and homeostatic mechanisms of fishes with emphasis on teleosts. Prerequisite: BiSc 163 or 156 or equivalent. (Spring, odd years)

265 Comparative Environmental Physiology (3) Packer
Survey of the physiological basis of adaptation of animals to diverse environments, emphasis on nonmammalian vertebrates. Prerequisite: BiSc 165 or equivalent. (Fall)

299–300 Thesis Research (3–3) Staff
(Fall and spring)

BUSINESS ADMINISTRATION

Professors R.B. Eastin, H.R. Page *(Emeritus)*, F. Amling, G. Black, P.D. Grub, G.P. Lauter, J. Zwick, N.M. Loeser, A. El-Ansary, W.J. Keegan, B. Burdetsky *(Chairman)*, S.F. Divita, R. Eldridge, R.F. Dyer, W.C. Handorf
Professorial Lecturers G.M. Arnaoot, J.P. Murphy, S.C. Silverberg, S. Thurm, S.A. Seelig, D.A. Peterson
Associate Professors S.N. Sherman, H.J. Davis, E.L. Hullander, F. Ghadar, J.M. Sachlis, Y.S. Park, P.B. Malone III
Associate Professorial Lecturers J.T. Heisler, J.H. Joseph, A.C. Meiners, Jr., A.G. Pieruccini, C.W. Richards, D.H. Watts, J.T. Heimbach
Assistant Professors T.M. Barnhill, D.R. Kane, N.G. Cohen, M.L. Liebrenz, L.M. Maddox, J.B. Thurman, P.S. Peyser, Y. Lee *(Visiting)*, M.S. Katzman, W. Margrabe
Assistant Professorial Lecturers M.W. Hudgins, M.J. Moran, M.A. Regalia, R.D. Rutz, H.F. Shamwell, Jr., C.C. Shepherd, J.M. Talens, D.E. Laufenberg, C.J. Prager
Lecturers R.M. Eldridge, G.I. Friend, G.S. Thomas

Programs of study in business administration leading to the degrees of *Bachelor of Business Administration, Master of Business Administration, and Doctor of Business Administration* are offered by the School of Government and Business Administration (see pages 131–62).

First Group

51 Introduction to Business (3) Katzman, Thurman
Structure, activities, and problems of business enterprise; its contribution to the individual and to society; careers in business. (Fall and spring)

Second Group

101 The Business Environment (3) Staff
Economic and legal environment of business enterprise; social and political influences; contemporary problems and issues. Restricted to seniors in the BBA program or with permission of instructor. (Fall and spring)

102 **Fundamentals of Management** (3) Davis, Malone, Thurman, Katzman
Planning, organizing, directing, coordinating, and controlling activities of the administrative unit; evolution of management thinking. (Fall and spring)

105 **Personnel Management** (3) Burdetsky, Malone
The labor force and labor markets. Industrial personnel and manpower programs, organization and policy in personnel activities. (Fall and spring)

106 **Leadership in Personnel Management** (3) Burdetsky
A study of the philosophy, principles, policies, and programs for effective personnel management and industrial relations as portrayed by case studies drawn from business and government. Prerequisite: BAd 105 or permission of instructor. (Fall)

107 **Collective Bargaining** (3) Burdetsky
American unionism and collective bargaining; economic, social, and public policy considerations. The negotiation and administration of collective bargaining agreements. Prerequisite: BAd 105 or permission of instructor. (Spring)

113 **Real Estate Investment** (3) Handorf
Principles of real estate investment including valuation, appraisal, financing, and development, in addition to a discussion of the mortgage market and its institutions. Prerequisite: BAd 131. (Fall)

121 **Fundamentals of Insurance and Risk Management** (3) Cohen
Function of insurance and risk management in business enterprise. (Spring)

131 **Business Finance** (3) Handorf, Barnhill, Sachlis, Cohen
Analyzing capital requirements and methods of acquiring funds; planning efficient use of capital. Asset management, financial analysis, sources of funds, capital budgeting, stockholder relationships. Prerequisite: Acct 51–52; Econ 1; Math 51–52; Stat 51. (Fall and spring)

132 **International Business Finance** (3) Eldridge, Hudgins
Analysis of the international economic environment and its influence on corporate financial management of international operations. (Fall and spring)

133 **Capital Formation** (3) Handorf
The process of capital formation in a free enterprise economy. Roles of business firms, financial intermediaries, money and capital market institutions, governmental regulatory agencies, fiscal and monetary policies. Prerequisite: BAd 131. (Spring)

134 **Working Capital Management** (3) Margrabe, Cohen
The analysis of corporate short-term sources and uses of funds. Optimization techniques and case studies emphasized. Bank lending practices evaluated within working capital area. Prerequisite: BAd 131. (Spring)

138 **Investment and Portfolio Management** (3) Amling, Cohen
Theory and principles of security analysis and portfolio management, including analysis of the national economy, industry, company, and security markets. Risk-reward and computer-aided analysis. Prerequisite: Acct 51–52, BAd 131.

139 **Advanced Financial Management** (3) Handorf, Barnhill
Analysis and readings investigating the theoretical relationships underlying financial management. Emphasis is placed upon cases for decisions involving long-term assets, financings, dividend policy, and other special topics in finance. Prerequisite: BAd 131.

141 Basic Marketing Management (3) El-Ansary, Liebrenz, Maddox, Friend
Role of marketing in the socioeconomic system, consumer behavior analysis, impact of consumerism. Major decision areas of product planning, pricing and distribution; tools of marketing research and demand analysis. Prerequisite: Econ 1–2, Stat 51. (Fall and spring)

143 Marketing Research (3) Dyer
Basic methods and techniques of marketing research, problem definition, data collection, market survey and experimental design, data analysis and presentation. Special topics: attitude research, questionnaire construction and concept testing. Prerequisites: BAd 141, Stat 51, Mgt 118. Laboratory fee, $15. (Fall and spring)

144 International Marketing Management (3) Lauter, El-Ansary, Liebrenz
Scope of international markets; factors in assessing world marketing opportunities; international marketing product, pricing, distribution, and promotion program development in dynamic world markets and global environment. Prerequisite: BAd 141. (Fall and spring)

145 Sales Management (3) Liebrenz, Divita
Organization of sales department, sales planning and forecasting, quotas, territories, performance standards, and analysis and control of distribution costs. Prerequisite: BAd 141, 143, 146. (Fall)

146 Consumer Behavior (3) Dyer, Maddox
An examination of the social, cultural, and psychological factors influencing the behavior of consumers. Topics include: models of buyer behavior, consumption patterns, market segmentation research, attitude formation and change, brand loyalty, the adoption of innovations, and store choice decisions. Marketing management and public policy implications of consumer research studies are stressed. Prerequisite: BAd 141 or permission of instructor. (Fall and spring)

147 Advertising (3) Maddox, Dyer, Thurm
Planning an advertising campaign. Consumer and market information, message appeals, media selection and scheduling, measuring effectiveness. Current criticism and regulation of the advertising function. Other major marketing communication tools, including personal selling and sales promotion, presented. Prerequisite: BAd 141, 143, 146. (Fall and spring)

148 Retailing Management Seminar (3) El-Ansary
A study of retailing management and strategy covering the current environment of retailing, retail market and financial analysis, store location and design, inventory management, and non-store and service retailing. Industry executive and student presentations and case analyses. Prerequisite: BAd 131, 141, 143, 146. (Spring)

149 Marketing: Strategic Planning (3) Divita, El-Ansary, Keegan
A capstone seminar for marketing majors. Analytical integration of material covered in previous marketing courses. Marketing strategy literature, financial dimensions of marketing management, and comprehensive cases. Prerequisite: BAd 141, 143, 145, 146, and one additional marketing major field course. (Spring)

161 Commercial Law (3) Staff
Fundamental concepts and principles of law encountered in business activity; contracts, bailments, agency, sales, negotiable instruments, bankruptcy, other topics. Basic legal considerations in business decision-making. (Fall and spring)

171 **Transportation and Logistics Management** (3) Sherman
Systems and alternatives of the logistics manager; carrier, user, and public policy perspectives; urban and inter-city mobility; cost, rate, competition, and service problems; public financing and regulation of carrier enterprise; coordination of the modes of transportation. (Fall)

175 **Introduction to International Business** (3) Grub, Hudgins
Social, cultural, political, legal, and technological environment of multinational business, emphasizing host-government/multinational corporation interface. Terminology, trade uses and practices, conditions essential for successful business operations, including export and import procedures, documentation, and legal requirements; physical movement of goods in international business. (Fall and spring)

176 **International Business Theory and Policy** (3) Eldridge, Lee
Theoretical relationships underlying international business transactions, governmental and corporate policy, significant trends and their causes. (Fall and spring)

178 **International Business Policy and Operations** (3) Grub, Thomas
Integration of functional activities in international and multinational firms, through selected case studies and discussions, to develop and stimulate decision-making from an overall business policy standpoint. Prerequisite: BAd 175. (Fall and spring)

181 **Manufacturing Production** (3) Hullander
Basic principles and methods of manufacturing production. Manufacturing facilities, plant and equipment. Illustrations selected from various process and fabrication industries. Prerequisite: Math 51, 53; Stat 51 or equivalent; BAd 102, 105. (Fall and spring)

182 **Small-Business Management** (3) Staff
Theory and practice of small business management. Focus on effective management of small firms, essentials of planning and organizing the firm, financial and administrative controls, evaluation of alternative business forms, and comparison of purchase of an on-going firm, franchising, and new business start-ups. The role of small business in American society; historical perspective of entrepreneurship. Prerequisite: BAd 102.

190 **Special Topics in Business Administration** (3) Staff
Experimental offering; new course topics and teaching methods.

198 **Business Policy and Administration** (3) Thurman, Katzman
Integration of functional activities in arriving at overall business policy decisions. Prerequisite: BAd 102, 105, 131, 141, 181. (Fall and spring)

199 **Individual Research** (arr.) Staff
Assigned topics. Admission by prior permission of advisor. May be repeated once for credit. (Fall and spring)

Third Group

201 **Social and Legal Environment of Business** (3) Kane
This course is a First-Level requirement for MBA students; it may not be used to satisfy a Second-Level requirement. Contemporary social forces acting on business management; business responsibility, ethics. Business under the U.S. Constitution, federal legislation, legal precedents and agency orders. Emphasis on court decisions relating to business. (Fall and spring)

202 **Business-Government Relations** (3) Black
Economic, political, and philosophical foundations of the business

government relationship in theory and practice. Antitrust, public utility, and other regulation, consumer and environmental protection, conditions of employment; effective business response—present status and future prospects. Prerequisite: BAd 201 or equivalent. (Fall and spring)

203 **Regulation of Business: Administrative Law** (3) Staff
Principles of federal regulation of business through administrative agencies. Analysis of sources and limits of agency powers and prerogatives in adjudicative, executive, and rule-making functions. Theoretical and practical aspects of regulation. A supervised research project involving observation and analysis of rule-making and adjudicatory processes is required. Prerequisite: BAd 201, 202, or equivalent. (Fall)

204 **Legal Aspects of International and Multinational Business** (3) Petersen
Legal environment of international and multinational business including legal systems, antitrust laws, regulation of direct investment, international arbitration and expropriation; topics of current interest. (Fall and spring)

205 **Business Representation and Lobbying** (3) Joseph
Strategies, tactics, and techniques used by business in representing itself to the legislative and executive branches and regulatory agencies of the federal government. Legal and practical constraints. Ethical considerations. (Fall)

206 **Seminar: Business, Economics, and Public Policy** (3) Black
Analysis and discussion of selected issues by students and representatives of government and business. Prerequisite: BAd 201, 202, or equivalent.

208 **Personnel Management** (3) Eastin, Loeser, Malone
Survey of personnel management practices and procedures, including labor-management relations. (Fall and spring)

209 **Seminar: Personnel Management** (3) Eastin
Industrial personnel and manpower management, research in advanced problems. (Spring)

210 **The Personnel Manager** (3) Eastin
The personnel manager and his or her place in the organization, relation to other executives, policy role and relations with chief executive. Problems of the senior personnel executive. Prerequisite: BAd 208 or permission of instructor.

211 **Leadership and Executive Development** (3) Loeser, Malone
Theories of managerial leadership; issues and problems associated with leadership in large organizations and at higher management levels; executive selection and development. Prerequisite: Mgt 200 or permission of instructor. (Fall and spring)

212 **Unionism and Collective Bargaining** (3) Burdetsky
The American labor movement. Collective bargaining and the conduct of labor relations under collective bargaining agreements. (Fall)

213 **Current Issues in Unionism, Collective Bargaining, and Labor Relations** (3) Burdetsky
Current problems and issues. Prerequisite: BAd 212. (Spring)

216 **Federal Government Regulation of Society** (3) Tolchin
Same as PAd 216.

290 **Business Financial Management** (3) Barnhill, Cohen, Peyser, Margrabe
This course is a First-Level requirement for MBA students; it may

not be used to satisfy a Second-Level requirement. Theory, policy, and practice in financial management; financial analysis, sources of funds, investing, capital planning, and budgeting. Prerequisite: Acct 201, Econ 217, Mgt 218 and 270, or equivalents. (Fall and spring)

231 **Financial Decision-making** (3) Sachlis, Peyser, Margrabe
Theory and practice of business finance with emphasis on special topics within valuation, including capital budgeting, mergers, acquisitions, bankruptcy, and liquidation. Prerequisite: BAd 131 or 230. (Fall and spring)

233 **International Business Finance** (3) Ghadar, Park, Zwick, Arnaoot
Analysis of problems in international business finance. Impact of the evolving international payments system on business. Prerequisite: BAd 131 or 230. (Fall and spring)

234 **Seminar: Capital Formation** (3) Handorf, Moran, Regalia
Determinants of saving and investment and resultant funds flow are evaluated. Special emphasis on the level and risk structure and term structure of interest rates. The role and management of financial institutions is stressed. Prerequisite: BAd 131 or 230. (Fall and spring)

235 **Financial Management** (3) Cohen, Barnhill
Cases in financial management; planning financial structure, obtaining and managing capital, issuing and placing securities, administering income, security arrangements. Prerequisite: BAd 231. (Fall and spring)

236 **Seminar: International Banking** (3) Park, Ghadar, Zwick
International financial intermediation and international banking. Functioning of international financial markets, public policy issues in international banking, regulation of multicountry banking institutions and the effect of international banks on national monetary policies. Prerequisite: BAd 233, 234. (Fall and spring)

237 **Investment Analysis** (3) Amling, Cohen
Risk-reward analysis of security investments including analysis of national economy, industry, company, and market; introduction to portfolio management; emphasis on theory and computer methods. Prerequisite: BAd 131 or 230. Laboratory fee, $15. (Fall and spring)

238 **Seminar: Investment and Portfolio Management** (3) Amling
Portfolio management theory, application, and computer modeling. Independent research on investment analysis and portfolio management with emphasis on theory, cases, and computer applications. Prerequisite: BAd 237. Laboratory fee, $15.

239 **Financial Theory** (3) Sachlis
In-depth theoretical analysis of business financial topics, including asset management, financial structure, dividend policy and the capital asset pricing framework. Prerequisite: BAd 231, 237.

240 **Marketing Management** (3) Dyer, Divita, El-Ansary, Liebrenz, Keegan
This course is a First-Level requirement for MBA students; it may not be used to satisfy a Second-Level Requirement. Emphasis on the marketing process from the viewpoint of the firm. Market analysis, product planning, channels of distribution, pricing, and promotional decision-making; developing an integrated marketing plan. Prerequisite: Econ 217–18. (Fall and spring)

241 **Advanced Marketing Management** (3) Divita, Keegan, Liebrenz
For MBA students in concentrations other than marketing. Case analysis of complex marketing problems. Current developments in

marketing practice. The relationship of marketing to environmental forces and other business functions. Prerequisite: BAd 240. (Fall and spring)

242 **Product/Service Strategy** (3) Dyer, Keegan
Management of the activities involved in marketing new and existing products and services. The innovation system (behavioral and organizational) of product decisions, product planning processes, product auditing, new products and the law, new product/service trends. Marketing of intangibles and services. Prerequisite: BAd 240, 243, 246. (Spring)

243 **Seminar: Marketing Research** (3) Dyer, Keegan
The marketing research process: designing, conducting, and using market research studies. Survey and experimental designs. Data analysis with statistical software packages. Prerequisite: BAd 240, Mgt 218 and 270, or equivalent. Laboratory fee: $15. (Fall and spring)

245 **Promotion Management/Marketing Communications** (3) Dyer, Maddox
Examination of promotion mix from a systems perspective supported by analytical methods and concepts regarding consumer attitudes and behavior. Topics: social context of promotion, role of communication in marketing, behavioral concepts and communications research, message design, economic and financial criteria, development of a promotion program. Prerequisite: BAd 240, 243, 246.

246 **Buyer Behavior** (3) Dyer, Maddox, Heisler
Examination of theory and recent research concerning buyer decision processes. Interdisciplinary behavioral science studies on individual, family, and organizational purchase behavior are treated. Present and potential applications for marketing in the public and private sector are illustrated with cases. Prerequisite: BAd 240 or permission of instructor.

247 **Marketing and Public Policy** (3) Divita
Examination of principal areas of public policy formulation affecting marketing practice. Topics: advertising, warranties, product safety, health issues, consumer information systems, informal and formal redress mechanisms, business responsibilities. Government business and advocate viewpoints presented. Prerequisite: BAd 240, 245, or 246; or permission of instructor. (Fall)

248 **International Marketing** (3) Lauter, El-Ansary, Liebrenz
Organizational structures. Analysis of international markets. Market-entry strategies and product policies. Special issues. Channels of distribution, promotional and price policies. Prerequisite: BAd 240. (Fall and spring)

249 **Marketing Strategy** (3) Divita, El-Ansary, Keegan
Analysis of complex marketing problems involving policy and operational decisions; emphasis on creative marketing strategy. Prerequisite: completion of at least three Second-Level marketing courses or permission of instructor. (Fall and spring)

250 **Sales Management** (3) Divita
(Formerly Industrial and Government Marketing)
The sales function from both the viewpoint of the sales person and the sales manager. The first part of the course will focus on the selling task, with attention to ethical and legal issues, the selling process, human behavior and selling, account management and internal selling, negotiation and non-selling aspects of sales work. The second part of the course will focus on the managerial issues asso-

ciated with sales management, with attention to demand analysis and resource allocation, financial planning, quota setting and control, motivation, coaching and incentives, sales administration, and analysis of sales performance. (Spring)

253 **Marketing Channels** (3) El-Ansary
Marketing channels and vertical marketing systems from a managerial viewpoint. Marketing channels viewed as super-organizations requiring planning, organization, coordination, and control. These tasks require an understanding of the channel's task environment, manufacturing, wholesaling, retailing, and physical distribution institutions. Focus on system performance and management of interorganizational relationships among channel institutions. Prerequisite: BAd 240. (Fall)

254 **Regional International Marketing Systems** (3) Lauter
Discussion of the political, economic, legal, and social characteristics of Europe, Japan, Latin America, Asia, the Middle East, Africa, the USSR, Eastern Europe, and China, as they affect the marketing of goods and services in these regions. Identification of appropriate market-entry strategies and discussion of selected case histories. Prerequisite: BAd 240, 248. (Fall and spring)

255 **Multinational Corporations in the World Economy** (3) Ghadar, Park, Grub, Zwick
Business in the world economy; multinational corporations as economic, political, and social institutions; ownership and growth strategies, relationships to other nations; national and international controls; future of the multinational corporation. (Fall and spring)

256 **Seminar: International Trade** (3) Eldridge
Classical and modern concepts of international trade theory, instruments and institutions of trade policy, barriers to trade, preferential treatment and trading blocs, trends and issues. (Fall and spring)

258 **External Development Financing** (3) Ghadar, Park
Problems and alternative solutions for required capital formation and the financing of payment imbalances through external sources. Institutions and instruments for financing national development. Emphasis on planning as affected by energy policies, inflation, recession, changes in the international monetary system and revised attitudes among developed countries regarding bilateral and multilateral assistance. Prerequisite: BAd 233 or permission of instructor. (Fall and spring)

259 **International Business Negotiations** (3) Ghadar
This course focuses on the essential characteristics of International Business Negotiations (IBN) with particular emphasis on the process and changes in that process over time. Formulation of concepts and preliminary frameworks to assist in understanding IBN; development of systematic approaches to planning for and conducting IBN. The course assists in developing skills of the participants in the art of IBN while integrating other functional and international aspects in the broader environmental framework. Prerequisite: BAd 255. (Fall and spring)

261 **Applied Microeconomics** (3) Black, Peyser
Applications of economic theory to public and private decisions affected by the economic and general business environment. Demand, production, costs, profits, investments, inventory, market structure. Prerequisite: Econ 217 and Mgt 270 or equivalents. (Spring)

262 **Macroeconomic Policy and Business** (3) Black
Interpretation of economic conditions in the short- and long-run;

theory and practice of monetary and fiscal policy; applications of business conditions analysis to business planning, management, and policy. Prerequisite: Econ 218 and Mgt 270 or equivalents. (Fall)

279 **Purchasing and Materials Management** (3) Sherman
Industrial purchasing and materials management principles and practices. Organization and functions in materials management. Determination of requirements, source selection, buying practices, policies, and ethics. Same as PAd 279. (Fall and spring)

280 **Procurement and Contracting** (3) Sherman
Principles and concepts essential to effecting large procurement programs. Planning, sourcing, and contractual design for diverse acquisitions. Emphasis on federal government policy with comparison of buying at other governmental levels and the private sector. Same as PAd 280. (Fall and spring)

282 **Government Contract Administration** (3) Sherman
Surveillance and management of contract performance. Measurement of progress; specification interpretation; quality assurance; changes, negotiation, and adjustment; financial considerations; property; terminations; regulatory and policy concerns. Same as PAd 282. (Spring)

283 **Pricing and Negotiation** (3) Sherman
Scope and objectives of negotiated procurement; preparation, conduct, and recording of negotiations; analysis of cost, price, profit, investment, and risk; cost principles; incentives; relationship of contract type to work requirements; techniques of negotiation. Prerequisite: permission of instructor. Same as PAd 283. (Fall)

285 **Systems Procurement and Project Management** (3) Sherman
Major systems acquisition: needs, objectives, and organizational relationships. Design, establishment, and execution of project management plans and procurement processes. Analysis of cases in public and private sector contractural or assistance activities. Same as PAd 285. (Spring)

290 **Special Topics in Business Administration** (3) Staff
Experimental offering; new course topics and teaching methods. May be repeated once for credit.

292 **New Venture Initiation** (3) Staff
Theory and practice of entrepreneurship and small business management. Historical perspective of entrepreneurship in the U.S. and abroad, essentials of planning a new business venture, sources of financing, evaluation of alternative new business ventures, and analysis of business functions needed to get started. On-going firms, franchising options, and new business start-ups. Prerequisite: Mgt 218, 270; Econ 217–18; BAd 201, 230, 240; Acct 201.

293 **Operations and Logistics Management** (3) Hullander
Management of work in production, commercial, service, and public organizations. Analytical tools for planning and establishing operating systems and for their operation, control, and modification. Examination of processes, products, services, equipment, and facilities. Relationships of human systems and operating systems. Prerequisite: Acct 201; Mgt 218, 270; Econ 217–18; BAd 201, 230, 240.

295 **Research Methods** (3) Davis
Theory and practice in research methodology. Data sources and gathering, research models and designs, analysis and testing, controls, interpretation and presentation of findings. Use of computer library programs and preparation of a formal business report. (Fall and spring)

297 **Business Policy Formulation** (3) Page, Eastin, Davis
This course is a First-Level requirement for MBA students; it may not be used to satisfy a Second-Level requirement. Analysis of operational situations and policy issues. Developing and implementing solutions to managerial problems. Prerequisite: advanced master's degree standing and completion of at least eight Second-Level MBA courses. (Fall and spring)

298 **Directed Readings and Research in Business Administration** (3) Staff
Supervised readings or research in selected fields within business administration. Admission by prior permission of instructor. May be repeated once for credit. (Fall and spring)

299 **Thesis Seminar** (3) Staff
Examination of thesis standards, research philosophy and methodology. (Fall and spring)

300 **Thesis Research** (3) Staff
(Fall and spring)

Fourth Group

Fourth-group courses are primarily for doctoral students. They are offered as the demand requires. They are open to other graduate students at the discretion of the Department.

311–12 **Seminar: Public-Private Sector Institutions and Relationships** (3–3) Staff
An analysis and critique of alternative theoretical frameworks for describing, understanding, and predicting the nature, values, and actions of American public and private institutions. Problems, potentials, and alternatives for structuring public and private institutional arrangements to meet the needs of society.

331 **Seminar: Financial Markets** (3) Sachlis, Peyser, Margrabe
Research seminar in corporate financial theory, investment portfolio theory, and capital market theory. May be repeated once for credit. Prerequisite: BAd 234, 238, 239.

341 **Seminar: Marketing** (3) El-Ansary, Dyer
Examination of major theoretical developments in marketing. Topics include advances in research methods, models and data analysis. Emphasis on emerging concepts in consumer behavior, channels, marketing communication and marketing information systems.

358 **Colloquium on International Business** (3) Eldridge, Grub, Zwick
Examination of selected topics in international business, with emphasis on major new theoretical and empirical developments. (Fall)

381 **Seminar: Materials and Operations Management** (3) Staff
Recent developments in manufacturing production and materials management; impact of technological, economic and social change; significant related trends. Private and public sector policy implications. New and emerging analysis techniques. Prerequisite: BAd 279, 280, or equivalent; or permission of instructor.

391 **Seminar: Business Management** (3) Burdetsky, Eastin
Examination of major current issues, both theoretical and empirical, affecting the development of the business enterprise. Topics to be announced. Emphasis on policy and strategic issues affecting the total enterprise.

398 **Advanced Reading and Research** (arr.) Staff
Limited to students preparing for the Doctor of Business Administration general examination. May be repeated for credit.

399 **Dissertation Research** (arr.) Staff
Limited to Doctor of Business Administration candidates. May be repeated for credit.

CHEMICAL TOXICOLOGY

See Forensic Sciences.

CHEMISTRY

Professors T.P. Perros *(Chairman)*, W.E. Schmidt, D.G. White, J.B. Levy, N. Filipescu, A.D. Britt, E.A. Caress, D.A. Rowley, T. Freund *(Research)*, A.C. Wahl *(Research)*
Associate Professors M. King, D. Ramaker
Assistant Professor A. Montaser

Bachelor of Arts or Bachelor of Science with a major in chemistry (departmental)—The department offers two undergraduate majors designed to give students broad training in the basic divisions of chemistry: analytical, inorganic, organic, and physical. *Major I* provides considerable concentration in chemistry. However, it permits a wider selection of electives and thus should meet the needs of students preparing to enter medicine, dentistry, or related fields. *Major II* is intended primarily for students preparing for graduate study in chemistry or those planning to enter the chemical profession and wishing to be certified to the American Chemical Society as having met the minimum requirements for professional training. Two foreign languages are recommended for students planning to do graduate work in chemistry.

The following requirements must be fulfilled:

1. Students in either Major I or Major II must meet the general requirements as stated on pages 71–72, 79–85. (Students should consult the departmental advisor regarding courses to be taken in satisfying the requirements for meaningful initiation into the humanities and social sciences.)

2. Prerequisite courses for Major I and Major II—Chem 11–12 and 22, or 15–16; Math 30, 31; Phys 1, 2.

3. (a) Required courses for Major I—BISc 11–12 or Geol 21–22 (required of Bachelor of Science degree candidates only); Chem 111–12, 113–14, 122, 134, 141, 151–52, 153–54.

(b) Required courses for Major II—BiSc 11–12 or Geol 21–22 (required of Bachelor of Science degree candidates only); Chem 111–12, 113–14, 122, 141–42 (or 156 in lieu of 142), 151–52, 153–54, 235; Math 32; one course selected from Chem 195, 207, 213, 221, 222, 251; ForS 240, 242; Math 111, 139; Phys 161, 165, 175; Stat 197.

Twelve semester hours in French, German, Greek, Hebrew, Italian, Latin, Russian, or Spanish (students in Major II should elect German) are recommended for students in both Major I and Major II.

For graduation with Special Honors in chemistry, a student must register for Chem 195 at the beginning of the senior year. The decision to award Special Honors will be based on competence in research and general achievement in chemistry as evaluated by the faculty.

Bachelor of Science/Master of Science in the field of chemical toxicology—This is a five-year program leading to the B.S. in the field of chemistry and the M.S. in the field of chemical toxicology. The first three years of the program consist of undergraduate course work. Application for admission to the M.S. program in chemical toxicology will be made to the Graduate School of Arts and Sciences during the second semester of the third year; for admission to the

graduate portion of the program acceptance must be obtained prior to the start of the fourth year of the program. If acceptance into the M.S. program in chemical toxicology is not desired or not obtained, the requirements for the B.S. in chemistry, either Major I or II, may be fulfilled by the successful completion of appropriate courses during the fourth year of study. If acceptance into the M.S. program in chemical toxicology is obtained, the B.S. in chemistry will be awarded after the successful completion of the fourth year of the program.

The following requirements must be fulfilled:

1. Students must meet the general requirements as stated on pages 71–72, 79–85, and 89–96. (Students should consult the departmental advisor regarding courses to be taken in satisfying the requirements for meaningful initiation into the humanities and social sciences.)

2. Course requirements: Chem 11–12, 22, 111–12, 113, 114, 122, 134, 141–42, 151–52, 153–54; Phys 1, 2; BiSc 11–12, 129; Math 30, 31, 32; Stat 127; Bioc 221–22; Phys 191 (for graduate credit); Phar 203; ForS 240, 242, 245; either ForS or Chem 299–300; and two courses chosen from ForS 246, 248, 249, 269.

3. Twelve semester hours of a foreign language are recommended.

Minor in Chemistry—Required: Chem 11–12, 22, 50, and 111; Chem 151, 152, 153, or 154 may be substituted for Chem 50.

Master of Science in the field of chemistry—Prerequisite: a bachelor's degree with a major in chemistry from this University, or an equivalent degree.

Required: the general requirements, pages 89–96. The required 30 semester hours of graduate work must include Chem 213 and 221, and at least two of the following: Chem 207, 236, and 251. The thesis requirement, Chem 299–300, may be in analytical, inorganic, organic, or physical chemistry. Chem 156, or its equivalent, is prerequisite to research work in the field of organic chemistry. A reading knowledge examination in German or Russian must be passed, or proficiency in computer programming must be demonstrated. A student who intends to become a doctoral candidate is strongly urged to take Chem 207 as early as possible in the master's program.

Master of Science in the field of geochemistry (an interdepartmental degree offered by the Departments of Chemistry and Geology)—Prerequisite: a bachelor's degree with a major in chemistry or in geology from this University, or an equivalent degree.

Required: the general requirements, pages 89–96, including Chem 111–12, 213, and 299–300, and Geol 141, 241, and 249. The Master's Comprehensive Examination must be taken before registration for the second half of the thesis work. A reading knowledge examination in a foreign language, approved by the Department of Chemistry or Geology must be passed prior to beginning the third semester of graduate work or before beginning the thesis work, whichever occurs first.

Doctor of Philosophy in the field of chemistry—Required: the general requirements, pages 89–91, 96–99. Chem 207, 213, 221, 235, 251, and 350 are normally required of the doctoral student, in addition to other courses as determined by consultation with the departmental program committee. A reading knowledge examination in German or Russian must be passed, *and* proficiency in computer programming must be demonstrated. Cumulative examinations replace the General Examination requirement.

Research fields: analytical chemistry, inorganic chemistry, organic chemistry, physical chemistry (electrochemistry, kinetics, magnetic resonance, theoretical), physical organic chemistry (reaction mechanisms), and structure and synthesis of natural products.

Ph.D. students in chemistry may substitute up to 12 hours of Dissertation Re-

search (Chem 399) in the form of course work jointly approved by the Chemistry Department and the Graduate Program in Science, Technology, and Public Policy. The purpose of this option is to provide a useful background for chemistry doctoral students who may be employed in government agencies dealing with science, technology, and public policy programs. The 12 hours may be selected from the following courses: PSc 222, 223, 252, 203, 217; PAd 214, 260; Mgt 233, 234.

Doctor of Philosophy in the field of geochemistry (an interdepartmental degree offered by the Departments of Chemistry and Geology)—**Required:** the general requirements, pages 89–91, 96–99, including a reading knowledge examination in an approved foreign language plus the satisfactory completion of Stat 117 and 118, or 91; and the satisfactory completion of the General Examinations in four fields, including chemistry and geochemistry.

Bachelor of Arts in Education and Human Development with a teaching field in chemistry—Prerequisite: the education curriculum, pages 111–12.
Required: the chemistry option and professional courses on page 115.

Graduate Placement Examinations: All entering students in the master's and doctoral programs in the field of chemistry are required to take the American Chemical Society Graduate Level Placement Examinations, given by the department of chemistry, prior to registration in the Graduate School of Arts and Sciences. The four placement examinations (in the disciplines of analytical, organic, inorganic, and physical chemistry) are of the multiple-choice type. These tests are designed to cover the subject matter in the disciplines generally taught in modern undergraduate programs preparatory for graduate work in chemistry, and the results are used by the department to advise the individual student in planning a program of courses appropriate to the student's background.

All graduate students are required to participate in the seminar and colloquium programs.

Registration: Before completing registration each student must obtain from the representative of the department an assignment to lecture, recitation and laboratory sections. The work of the junior and senior years must be approved by the department.

PHYSICAL SCIENCE

First Group

3–4 Contemporary Science for Nonscience Majors (3–3) Filipescu
Lecture (2 hours), laboratory (3 hours). Contemporary topics in physical, biological and medical science. Chem 3 is not prerequisite to Chem 4 but both courses must be satisfactorily completed to fulfill the meaningful initiation requirement. Laboratory fee, $20 per semester. **(Academic year)**

CHEMISTRY

First Group

11–12 General Chemistry (4–4) Britt, Perros, Rowley, White
Lecture (3 hours), laboratory (3 hours), recitation (1 hour). Elementary course in general chemistry, including qualitative analysis. Prerequisite to Chem 11: one year of high school algebra. Prerequisite to Chem 12: Chem 11. Laboratory fee, $35 per semester. **(Chem 11 and 12—fall and spring)**

13 General Chemistry (4) Britt
For engineering and applied science students only. Lecture (3 hours), laboratory (3 hours), recitation (1 hour). Atomic structure, chemical bonding; chemical equations; acids and bases; chemical equilibrium; liquid and solid states; periodicity; electrochemistry; organic chemistry. Prerequisite: Math 31, Phys 14 or 15. Laboratory fee, $35. (Fall and spring)

15–16 Intensive General and Analytical Chemistry (4–4) Staff
(Honors Course)
Chem 15: Lecture (3 hours), laboratory (3 hours), recitation (1 hour). Chem 16: Lecture (2 hours), laboratory (6 hours), recitation (1 hour). Equivalent to Chem 11–12 and 22, but with selected topics studied in depth. Prerequisite to Chem 15: high school physics and chemistry. Prerequisite to Chem 16: Chem 15. Admission by placement test prior to registration or on basis of College Board Advanced Placement Examination. Laboratory fee, $35 per semester. (Academic year)

22 Introductory Quantitative Analysis (4) Staff
Lecture (2 hours), laboratory (6 hours). Theory and practice of quantitative analysis by classical methods; introduction to instrumental analysis. Prerequisite: Chem 12. Laboratory fee, $35. (Fall and spring)

50 Introduction to Organic Chemistry (4) Caress
Lecture (3 hours), laboratory (3 hours). A terminal course for students in related disciplines. This course does not fulfill the organic chemistry requirement for chemistry majors or premedical students. Prerequisite: Chem 12 or 16. Laboratory fee, $35. (Spring)

Second Group

110 Introduction to Physical Chemistry (3) Levy
Topics include chemical thermodynamics, chemical kinetics, electrochemistry, solution chemistry, membrane and phase equilibria, and others. Prerequisite: Chem 16 or 22, Math 31, Phys 2; or permission of instructor. Not open to chemistry majors. May not be taken for credit by students who have received credit for Chem 111–12 or an equivalent course. (Summer)

111–12 Physical Chemistry (3–3) Ramaker and Staff
Gas laws, chemical thermodynamics, chemical equilibrium, kinetics, quantum chemistry, atomic and molecular spectra, structure of solids, liquids, and macromolecules. Prerequisite to Chem 111: Chem 16 or 22; Math 31; Phys 2. Prerequisite to Chem 112: Chem 111. (Academic year)

113 Physical Chemistry Laboratory (2) Ramaker, Schmidt
Laboratory complement to Chem 111. Prerequisite or concurrent registration: Chem 111. Laboratory fee, $35. (Fall)

114 Instrumental Analysis Laboratory (2) Schmidt, Ramaker
Laboratory complement to Chem 112 and 122. Prerequisite or concurrent registration: Chem 112, 113, and 122. Laboratory fee, $35. (Spring)

122 Instrumental Analysis (3) Montaser
Theory of instrumental methods in qualitative and quantitative analysis, determination of structure, and study of reaction mechanisms with emphasis on electroanalysis, spectrophotometry, and chromatography. Correlated with Chem 114. Prerequisite or concurrent registration: Chem 112. (Spring)

134 Descriptive Inorganic Chemistry (2) **Perros**
Intermediate-level course emphasizing the descriptive chemistry of the elements. Prerequisite: Chem 16 or 22, 152. Prerequisite or concurrent registration: Chem 111. (Fall)

141–42 Advanced Experimental Chemistry (2–2) **White, Caress**
Designed to provide the chemistry major with facility in experimental methods common to all disciplines of chemistry. Prerequisite: Chem 154. Prerequisite or concurrent registration: Chem 111. Laboratory fee, $35 per semester. (Academic year)

151–52 Organic Chemistry (3–3) **Levy, King**
Chemistry of the compounds of carbon. Prerequisite to Chem 151: Chem 12 or 16. Prerequisite to Chem 152: Chem 151. (Academic year)

153–54 Organic Chemistry Laboratory (1–1) **Staff**
Laboratory complement of Chem 151 52. Prerequisite or concurrent registration: Chem 151-52. Prerequisite to Chem 154: Chem 153. Laboratory fee, $35 per semester. (Academic year)

156 Qualitative Organic Analysis (3) **King**
Lecture (1 hour), laboratory (6 hours). Separation of mixtures such as essential oils, peptides, commercial pharmaceuticals, carbohydrates, and/or others as appropriate; identification of their components using spectroscopic techniques. Lecture emphasizes the practical considerations in separation methods (including GLPC, TLC, and HPLC) and the spectral interpretation of unknown substances. Prerequisite: Chem 16 or 22, 154. Laboratory fee, $35. (Spring, odd years)

191 History of Chemistry (2) **Perros**
Historical development of chemistry from antiquity to the 20th century. Prerequisite: Chem 12 or 16. (Spring)

195 Undergraduate Research (1 or 2) **Staff**
Research on problems approved by the staff. Approval must be obtained prior to registration. May be repeated once for credit. Laboratory fee, $35 per semester hour. (Fall and spring)

Third Group

201-2 Interdisciplinary Science (4–4) **Levy, Merchant, Parke**
Joint offering of the Departments of Biological Sciences, Chemistry, and Physics. A treatment of scientific methodology and knowledge, both principles and facts. Designed to provide a basic understanding of the natural sciences and of the nature of science itself. Overview of the known fundamental principles developed in scientific observation of the physical universe. Fundamental principles are applied to systems of increasing complexity, with emphasis on physical, chemical, and biological systems. Students enrolled in natural science programs may not take this course for credit. Prerequisite: high school algebra or equivalent.

207 Chemical Bonding (3) **Ramaker**
Quantum mechanics, approximate methods, electron spin, Pauli principle, atomic and molecular structure. Prerequisite: Chem 112. (Fall)

211–12 Physical Chemistry (2–1) **Ramaker and Staff**
Same as Chem 111 12. Admission only by departmental permission. Credit assigned upon satisfactory completion of Chem 213. (Academic year)

213 Chemical Thermodynamics (3) **Staff**
Application of thermodynamics to chemical problems. Thermochemis-

try, homogeneous and heterogeneous equilibria, statistical calculation of thermodynamic properties, electrochemistry. Prerequisite: Chem 112 or 212. (Spring)

216 **Statistical Mechanics** (3) Ramaker
Introduction to classical and quantum statistics designed to acquaint students with basic principles and methods. Prerequisite or concurrent registration: Chem 207 or permission of instructor. (Offered as the demand requires)

218 **Molecular Spectroscopy** (3) Ramaker
Applications of quantum chemistry, molecular orbital theory, valence bond theory, vibration and rotation of molecules. IR and electronic spectroscopy. Prerequisite: Chem 207. (Spring, odd years)

221 **Advanced Analytical Chemistry I** (3) Montaser
Theory and application of recent spectrometric methods of analysis, including electrical, magnetic, and optical instrumentation. Prerequisite: Chem 122. (Fall)

222 **Advanced Analytical Chemistry II** (2 or 3) Schmidt
Lecture (2 hours), laboratory (3 hours—optional). Theory and application of electroanalysis and separations by physiochemical methods. Prerequisite: Chem 122. Laboratory fee, $21. (Spring, even years)

233 **Organometallic Chemistry** (3) White
Survey of organometallic compounds with emphasis on the compounds of lithium, boron, aluminum, silicon, the transition metals, and the catalytic role of certain organotransition metal complexes. Prerequisite: Chem 235 and 251, or permission of instructor. (Spring, even years)

235–36 **Advanced Inorganic Chemistry** (3–3) Rowley
Application of modern chemical theories to inorganic substances and reactions followed by a detailed study, developed from the periodic table, of the chemistry of the more common elements. Prerequisite to Chem 235: Chem 112, 152. Prerequisite to Chem 236: Chem 235. (Academic year)

251–52 **Advanced Organic Chemistry** (3–3) Filipescu
Synthesis, reactions, and properties of organic compounds; fundamental theories of organic chemistry, emphasis on reaction mechanisms. Prerequisite to Chem 251: Chem 112, 152. Prerequisite to Chem 252: Chem 251. (Academic year)

257 **Physical-Organic Chemistry** (3) Levy
The transition state theory of chemical kinetics, applications to reaction mechanisms; kinetic isotope effects, linear-free energy relationships, concentrated and "super" acids, Woodward-Hoffman rules, free radical reactions. Prerequisite: Chem 252 or permission of instructor. (Fall, odd years)

258 **Synthesis and Structure Determination in Organic Chemistry** (3) Caress
Methods of structure determination and synthesis of complex organic molecules. Prerequisite: Chem 251 or permission of instructor. (Fall, even years)

259 **Polymer Chemistry** (3) Barkin
A study of the preparation, properties, and structure of macromolecules. Prerequisite: Chemistry 152 and 111 or permission of instructor. (Fall)

295 **Research** (arr.) Staff
Research on problems approved by the staff. Open to qualified stu-

dents with advanced training. May be repeated for credit not to exceed a total of 8 semester hours. Laboratory fee, $35 per semester hour. (Fall and spring)

299–300 **Thesis Research** (3–3) **Staff**
(Fall and spring)

Fourth Group

350 **Choice and Design of a Research Problem** (1) **Staff**
Development in written form of an original research plan, fully referenced, and its oral defense. If a grade of C is received, the student must repeat this course for credit and must develop a new research plan. (Fall and spring)

398 **Advanced Reading and Research** (arr.) **Staff**
Limited to students preparing for the Doctor of Philosophy cumulative examinations. May be repeated for credit. (Fall and spring)

399 **Dissertation Research** (arr.) **Staff**
Limited to Doctor of Philosophy candidates. May be repeated for credit. (Fall and spring)

CHINESE

See **East Asian Languages and Literatures.**

CLASSICS

Associate Professors J.E. Ziolkowski *(Chairman)*, E.A. Fisher
Associate Professorial Lecturer M.E. Norton
Assistant Professor M.D. Ticktin
Assistant Professorial Lecturer Y.M. Moses

Bachelor of Arts with a major in classical humanities (departmental)—The following requirements must be fulfilled:

1. The general requirements as stated on pages 71–72, 79–85.
2. Prerequisite courses—Clas 1-2, 3, 4; or equivalent; or Clas 11–12, 13–14; or equivalent; and Clas 71, 72. Students may substitute for Clas 3, 4, or 13–14 two additional courses (6 semester hours) consisting of Clas 64 and a course to be selected in consultation with the departmental advisor.
3. Required courses in the major—(a) 12 semester hours selected from second-group classics courses; (b) 18 semester hours selected from Art 101, 102, 103, 112, 155; Hist 105, 107, 108, 109, 110, 111, 209; Phil 111; PSc 105; Rel 143.

Bachelor of Arts with a major in classical archaeology and classics (departmental)—An interdepartmental major arranged in conjunction with the Department of Art. The following requirements must be fulfilled:

1. The general requirements as stated on pages 71–72, 79–85. (Students should consult the departmental advisor regarding courses to be taken in satisfying the requirement for meaningful initiation into the natural and mathematical sciences.)
2. Prerequisite courses—Clas 1–2, 3, 4; or Clas 11–12, 13–14.
3. Required courses in the major—Art 101, 102, 112, 155; three courses selected from Hist 107, 108, 109, 110, 209; 12 semester hours in second-group courses in Greek or Latin. (A reading knowledge of French and German is recommended.)

Minor in classical humanities—(a) 6 semester hours selected from Clas 1–2 or 11–12; (b) 9 semester hours selected from Clas 3, 4, 13, 14, 71, 72, 105, 108, 113, 127, 134, 170, 185, 186; (c) 6 semester hours selected from Art 101, 102, 103, 111; Hist 107, 108, 109, 110.

COURSES IN GREEK, HEBREW, LATIN, AND YIDDISH

First Group

1–2 Beginning Latin (3–3) — Ziolkowski
A year course; credit toward a degree at this University given on completion of Clas 2. Grammatical essentials of the language, appropriate reading selections, development of English derivatives, introduction to Roman life and literature. (Academic year)

3 Intermediate Latin: Prose and Poetry (3) — Norton
Development of ability to read and understand Latin literature of moderate difficulty. Prerequisite: Clas 1–2 or equivalent. (Fall)

4 Vergil's Aeneid (3) — Norton
Significant passages of Vergil's famous epic—in Latin; reading and discussion of the entire poem in translation. Prerequisite: Clas 3 or permission of instructor. (Spring)

11–12 Beginning Greek: Classical (3–3) — Fisher
A year course; credit toward a degree at this University given on completion of Clas 12. Study of the grammar, vocabulary, and structure of Greek. Reading of selected ancient authors. (Academic year)

13–14 Intermediate Greek: Classical (3–3) — Staff
Review of grammar; extensive reading of prose and poetry: e.g., Homer, Herodotus, or a play. (Academic year)

21–22 Beginning Hebrew (3–3) — Ticktin
A year course; credit toward a degree at this University given on completion of Clas 22. Grammatical essentials of the language; readings selected from classical and modern texts; basic audio-lingual drills for comprehension and expression. Laboratory fee, $17.50 per semester. (Academic year)

23–24 Intermediate Hebrew (3–3) — Moses
Intensive readings and text analysis, with opportunities to develop basic skills. Materials range from Israeli newspapers and scholarly journals to liturgical poetry and rabbinic narratives. Laboratory fee, $17.50 per semester. (Academic year)

25–26 Yiddish for Reading and Conversation (3–3) — Ticktin
Grammatical essentials of the language, appropriate reading selections, conversational exercises for beginners. (Academic year)

Second Group

103 Modern Hebrew Nonfiction (3) — Moses
Directed readings in humanities and social sciences. Development of linguistic skills necessary for independent research. May be repeated for credit. (Fall)

104 Modern Hebrew Fiction (3) — Moses
Study of selected modern Israeli short stories and poems. May be repeated for credit. (Spring)

109–10 Major Latin Authors (3–3) — Ziolkowski
Selections from one or two major authors will be read each semester. May be repeated for credit. Prerequisite: Clas 3–4 or permission of instructor. (Academic year)

134 Medieval Latin (3) — Andrews
Selections from the Vulgate and representative Latin writers through the 11th century. Prerequisite: Clas 3, 4; or permission of instructor. May be taken for graduate credit with approval of instructor. (Spring)

139–40 Major Greek Authors (3–3) — Staff
Selections from a wide variety of Greek prose, drama, and poetry.

suited to the needs of the class. May be repeated for credit with permission of instructor. Prerequisite: Clas 14. (Academic year)

185–86 **Directed Reading** (1, 2, or 3) Staff
Reading of material in the student's field of interest. Admission by permission of instructor. May be taken for graduate credit.

COURSES IN ENGLISH TRANSLATION

First Group

41 **Roots of the Western Tradition** (3) Staff
Same as Engl/Hist/Phil/Rel 41. Basic ideas of western thought from early Greek, Roman, Judaic, and Christian traditions. Representative readings in drama, epic, historical writings, oratory, creation stories, scriptural traditions, philosophy, and spiritual autobiography. To be taken in conjunction with Engl 13. (Spring)

63 **Greek and Latin Origins of Medical Terms** (3) Ziolkowski
Mastery of medical terminology by learning word elements from Greek and Latin and the principles which govern both the formation of medical words and the derivation of their meanings. (Fall)

64 **Greek and Latin Origins of English Words** (3) Fisher
Study of Greek and Latin elements in English to improve vocabulary and facilitate understanding of the language of science, philosophy, politics, etc. (Spring)

71 **Greek Literature and Civilization** (3) Fisher
Study of ancient Greek civilization with focus on public and private life as seen primarily through literature. (Fall)

72 **Roman Literature and Civilization** (3) Ziolkowski
Study of Roman civilization with focus on public and private life as seen primarily through literature. (Spring)

100 **Modern Hebrew Literary Classics** (3) Ticktin
Prose and poetry of a century of writing from the beginning of the Hebrew literary renaissance to contemporary Israeli literature, including works of Bialik, Agnon, Peretz, Hazaz, Amichai, and Oz.

Second Group

101 **Israeli Society and Culture: Literary Perspectives** (3) Ticktin
A study of literature reflecting such contemporary issues as the conflict between the "builders' generation" and their children; the cultural contacts of Ashkenazim and Sefardim; image of the Arab; impact of the Holocaust; Zionist ideals and current realities. (Fall)

102 **Contemporary Israeli Short Stories and Poetry** (3) Ticktin
An introduction to post-1948 writers, including A. B. Yehoshua, Amos Oz, David Shahar, Aharon Apfelfeld, Dahlia Ravikovitch, Yehuda Amichai, Haim Gury, Amir Gilboa, and Amalia Kahana-Karmon. (Spring)

105 **Special Topics in Classical Literature** (3) Staff
Focus on a selected topic, such as athletics in classical antiquity or the hero, or on study of a genre, such as satire or oratory. May be repeated for credit.

108 **Classical Mythology** (3) Norton
Mythology of the Greeks and Romans from the creation of the world: tales of the gods, heroes, and great families that have influenced literature, art, and music. (Fall)

113 **Greek and Roman Drama** (3) Staff
Selected masterpieces of Greek and Roman tragedy and comedy. (Spring)

127 Classical Influence on Western Civilization (3) Ziolkowski
A survey of Greek and Roman influence on Western civilization relevant to modern America: literature, art, law, science, philosophy, etc.

170 Women in Classical Antiquity (3) Norton
In-depth study and discussion of readings from ancient and modern sources on the role of women in Greek and Roman society. (Spring)

CRIME IN COMMERCE

See **Forensic Sciences.**

CRIMINAL JUSTICE

See **Forensic Sciences** and **Sociology.**

DANCE

See **Human Kinetics and Leisure Studies.**

DRAMA

See **Speech and Drama.**

EARLY MODERN EUROPEAN STUDIES

Committee on Early Modern European Studies
R.E. Kennedy *(Chairman)*, F.S. Grubar, C.A. Linden, G.E. Mazzeo, J.P. Reeving, Jr., R.H. Schlagel, K. Thoenelt, D. Wallace

The Columbian College of Arts and Sciences offers an interdisciplinary program in Early Modern European Studies. This humanities program is designed to enhance the student's understanding of the history, philosophy, religion, science, literature, and art of the five centuries (1300-1800) during which the Western World began to take on its modern dimensions. The program is directed by an interdepartmental committee.

Bachelor of Arts with a major in Early Modern European Studies—The following requirements must be fulfilled:

1. The general requirements as stated on pages 71–72, 79–85.
2. Requirements for the major:
   a. Six semester hours of third year level French, German, or Spanish literature courses taught in the language, from among the following: Fren 120, 121–22, 123–24; Ger 103–4, 111–12, 131–32; Span 121–22, 123–24, 125.
   b. Phil 112
   c. Rel 145
   d. PSc 106
   e. Twenty-seven semester hours of art history, history, and English literature, with the course distribution to be determined in consultation with the program advisor, and with a minimum of 6 hours from each of the following: Art 104–5, 106–7, 108, 113–14, 121–22; Engl 125–26, 127–28, 129, 130, 131–32; Hist 101, 105, 121–22, 123, 141, 148, 151, 153, 154.

EAST ASIAN LANGUAGES AND LITERATURES

Professor C.W. Shih *(Chairman)*
Associate Professor J. Chaves
Assistant Professors G.C.Y. Wang, D.L. Lee
Lecturers M. Wang, N. Williams

Bachelor of Arts with a major in Chinese Language and Literature—The requirements are as follows:

1. The general requirements as stated on pages 71–72, 76, and 168. (Sixty semester hours from Columbian College, or the equivalent from another accredited institution are required.)
2. Prerequisite courses—Chin 5–6 (preferred); or Chin 1–2, 3–4, and 9; or Chin 7–8 and 9.
3. Required for the major:

(a) *Departmental major in the School of Public and International Affairs*—Chin 11–12, 109–10, and 163–64; plus 12 additional semester hours of second-group Chinese literature courses. The student is required to pass a major examination at the end of the senior year. The coordinated field of knowledge upon which the student will be examined includes an active command of modern Chinese language and a general knowledge of Chinese literature and culture. A proseminar (Chin 199–200) assists the student in preparation for the major examination.

(b) *Field-of-Study major in Columbian College of Arts and Sciences*—Completion of Chin 11–12, 109–10, 163–64, and the passing of the major examination at the end of the senior year. The coordinated field of knowledge upon which the student will be examined includes an active command of modern Chinese language and a general knowledge of Chinese literature and culture. A proseminar (Chin 199–200) assists the student in preparation for the major examination.

Bachelor of Arts with a major in East Asian Studies (China or Japan)—See pages 71–72, 77, and 168–69.

A Junior Year Abroad Program is available.

Master of Arts in East Asian Studies with a concentration in Chinese Language and Literature. **The requirements are as follows:**

1. The general requirements as stated on pages 171–75.
2. Prerequisite: 24 semester hours of Chinese language.
3. 12 semester hours of Chinese literature, 6 hours of history, and 6 hours of relevant East Asian courses.
4. 6 semester hours of thesis research.

CHINESE

First Group

*1–2 **Beginning Mandarin Chinese, Level I** (3–3) G. Wang
Classroom (3 hours), laboratory (1 hour). Fundamentals of grammar and pronunciation with graded reading and practice in writing. Prerequisite to Chin 2: Chin 1. Laboratory fee, $17.50 per semester. (Academic year)

*3–4 **Beginning Mandarin Chinese, Level II** (3–3) G. Wang
Classroom (3 hours), laboratory (1 hour). Continuation of grammar and spoken Chinese with more emphasis on the written language and

* The combination of Chin 1-2, 3-4, and 9, or the combination of Chin 7-8 and 9, is equivalent to Chin 5-6.

reading. Prerequisite to Chin 3: Chin 2 or equivalent. Prerequisite to Chin 4: Chin 3. Laboratory fee, $17.50 per semester. (Academic year)

5–6 **Beginning Intensive Mandarin Chinese, Levels I-II** (8–8) Lee
Intensive beginner's course in fundamentals of grammar and pronunciation with graded reading and practice in writing. Prerequisite to Chin 6: Chin 5. Laboratory fee, $17.50 per semester. (Academic year)

*7–8 **Beginning Intensive Mandarin Chinese** (6–6) Lee, Wang
Intensive beginner's course in fundamentals of grammar and pronunciation with graded reading and practice in writing. Prerequisite to Chin 8: Chin 7. Laboratory fee, $17.50 per session. (Summer)

*9 **Beginning Mandarin Chinese, Level II** (4) Lee
Reading of simple modern expository writings. Analysis of syntactic structure and practice in writing. Prerequisite: Chin 4 or 8. Laboratory fee, $17.50. (Fall or spring)

10 **Chinese Calligraphy** (1) M. Wang
Design and writing of Chinese characters with traditional writing implements. No knowledge of the language required. May be repeated for credit. (Fall and spring)

11–12 **Intermediate Intensive Mandarin Chinese** (6–6) G. Wang
Reading of basic texts, writing of short pieces, conversation, systematic review of grammar. Prerequisite to Chin 11: Chin 6 or 9. Prerequisite to Chin 12: Chin 11. Laboratory fee, $17.50 per semester. (Academic year)

13–14 **Reading Chinese for Beginners** (4–4) Staff
Basic grammar and syntax of modern Chinese; development of reading ability in beginners' textbooks and newspapers. Primarily for graduate students who wish to acquire a reading knowledge without learning to speak or write the language. (Academic year)

22 **Intermediate Chinese Conversation** (2)
A practical course for improving speaking ability. Prerequisite: 6 credit hours of Chinese or equivalent. May be repeated for credit

†91 **East Asia—Past and Present** (3) Johnson and Associated Faculty
An interdisciplinary course, introducing the student to a comprehensive and integrated understanding of the civilization and present problems of East Asia. (Spring)

93–94 **East Asian Literature—in Translation** (3–3) Staff
Lecture and discussion. Survey of Chinese and Japanese literature from earliest periods through literary masterpieces of the early 20th century. (Academic year)

Second Group

107–8 **Readings in Modern Chinese** (3–3) Staff
Intensive readings in selected modern literary works, social science materials, and documentary materials. Prerequisite: Chin 12 or equivalent. (Academic year)

109–10 **Introduction to Classical Chinese** (3–3) Shih
Introduction to classical writing in Chinese literature, history, and philosophy. Prerequisite: Chin 6 or 9. (Alternate academic years)

123–24 **Introduction to Chinese Linguistics** (3–3) Lee
Introduction to the history of the Chinese language. Analysis of

* The combination of Chin 1-2, 3-4, and 9, or the combination of Chin 7-8 and 9, is equivalent to Chin 5-6.

† An interdepartmental course offered by the East Asian Languages and Literatures, Economics, Geography and Regional Science, History, Philosophy, Political Science, and Religion Departments.

linguistic structure of modern spoken Chinese and classical Chinese. Prerequisite: Chin 6 or equivalent, or a course in linguistics. (Alternate academic years)

181–82 **Introduction to Chinese Culture** (3–3) Staff
Survey of the Chinese cultural heritage—literature, philosophy, art, religion, and social history—from pre-history to the modern era. Lecture and discussion in English.

163–64 **Chinese Literature in Translation** (3–3) Chaves
An introductory course focusing on major works of poetry, drama, and the novel in their historical and social context. (Academic year)

179–80 **20th-Century Chinese Literature** (3–3) Shih
Works of Lu Xun, Lao She, and others. Drama of Tian Han and Cao Yu. Prerequisite: Chin 107 or equivalent. (Alternate academic years)

181 **Literature in Traditional Chinese Society** (3) Chaves
Introduction to the various roles played by literature in pre-modern China, as well as the reflection of society in traditional literature. May be taken by graduate students for graduate credit with permission of instructor.

182 **Fiction and Drama in the People's Republic of China** (3) Chaves
Survey of stories, novels, and plays in the PRC, and their role in political and social events. May be taken by graduate students for graduate credit with permission of instructor.

183 **Poetry in the People's Republic of China** (3) Chaves
Survey of poets in the PRC, including Mao Ze-dong; the role of poetry in political commentary and protest. May be taken by graduate students for graduate credit with permission of instructor.

185–86 **Directed Reading** (3–3) Staff
Reading of material in the student's field of interest. Admission by permission of instructor. (Academic year)

199–200 **Proseminar: Readings for the Major in Chinese Language and Literature** (3–3) Staff
Conferences and group discussions. (Academic year)

Third Group

271–72 **Poetry of the Tang and Song Periods** (3–3) Chaves
Reading of works of leading poets. Discussion of content and style. Prerequisite: Chin 109 or equivalent. (Alternate academic years)

273 **Yuan Drama** (3) Shih
Readings of plays by Guan Han-quin, Ma Zhi-Yuan, and others. Prerequisite: Chin 109 or equivalent.

277–78 **Prose Narratives of the Song, Ming, and Qing Periods** (3–3) Shih
Short stories of the Song period. Selected readings of Ming-Qing novels. Historical development and stylistic traits. Prerequisite: Chin 107 or equivalent. (Alternate academic years)

299–300 **Thesis Research** (3–3)

JAPANESE

First Group

1–2 **Beginning Japanese, Level I** (4–4) Williams
Lecture (4 hours), laboratory (1 hour). Fundamentals of grammar and pronunciation with graded reading and practice in writing. Prerequisite to Japn 2: Japn 1. Laboratory fee, $17.50 per semester. (Academic year)

3–4 **Beginning Japanese, Level II** (4–4) Williams
Lecture (4 hours), laboratory (1 hour). Continuation of grammar with more emphasis on written language and reading. Prerequisite to Japn 3: Japn 2. Prerequisite to Japn 4: Japn 3. Laboratory fee, $17.50 per semester. (Academic year)

Second Group

111–12 **Japanese Literature in Translation** (3–3) Chaves
An introductory survey of traditional and modern Japanese literature read in English translation: love and nature poetry; theater (classical drama, puppet plays); fiction; diaries. Particular emphasis is placed on the great women writers of Japan. (Academic year)

ECONOMICS

Professors J.W. Kendrick, C.T. Stewart, Jr. *(Chairman)*, J. Aschheim, R.P. Sharkey, H. Solomon, S. Levitan, T. Suranyi-Unger, Jr. *(Research)*, C.Y. Hsieh, J.L. Gastwirth, M.A. Holman, R.M. Dunn, Jr., W.F.E. Long, S.E. Haber, A. Adams *(Research)*, R.S. Goldfarb, J.R. Barth, A.E. Burns *(Emeritus)*, R.M. Scheffler

Adjunct Professors T.F. Carroll, J. Grunwald, P. Swamy, J. Hardt, E.M. Hadley, V. Tanzi

Professorial Lecturers T.D. Simpson, R.E. French, D. McNicol, A.R. Grimes, D.W. Breneman

Associate Professors R.Y. Yin, A.M. Yezer, O. Havrylyshyn, J.J. Cordes, J. Pelzman, B.L. Boulier, J.E. Kwoka, R.P. Trost, C.B. Knapp *(Visiting)*

Associate Professorial Lecturers J.E. Fredland, S.A. Rhoades, T.K. Morrison

Assistant Professors M.R. Metzger, V. Fon, H.S. Watson, M.L. Marlow, G.E. Wright, Jr., W.A. Anderson, J.P. Link

Assistant Professorial Lecturers R. Meese, E. Offenbacher, E. Suss, R. Bernknopf, G. Caprio, N. Behravesh, I. Kyriakopoulos, C.M. Aho

Bachelor of Arts with a major in economics (departmental)—The following requirements must be fulfilled:

1. The general requirements as stated on pages 71–72, 79–85. (Students should consult the departmental advisor regarding courses to be taken in satisfying the requirement for meaningful initiation into the humanities and the natural and mathematical sciences.)

2. Prerequisite course—Econ 1–2.

3. Required courses in related areas—Math 41 and 42, or equivalent; Stat 111 and 112, or equivalent; six semester hours of a social science other than economics.

4. Required courses in the major—Econ 101, 102, 121, 198, and 15 additional semester hours of second-group economics courses to be approved by the departmental advisor.

Minor in economics—a) 18 credit hours in economics, including Econ 1, 2, 101, 102, 121, and one other 100-level course in economics; b) 6 credit hours of an approved statistics sequence, such as Stat 111–12; or 6 hours selected from Math 31, 32, 41–42, 51–52; or 3 hours of an approved statistics course plus 3 hours selected from Math 31, 32, 41–42, 51–52.

Master of Arts in the field of economics—Prerequisite: a Bachelor of Arts degree with a major in economics from this University, or an equivalent degree. An understanding of basic calculus is assumed for those entering the Master of Arts program in economics.

Required: the general requirements, pages 89–96, including (1) Econ 203–4, 205, and 275 or 279; (2) 12 additional semester hours to be selected from other third-group economics courses; (3) a Master's Comprehensive Examination in economic theory; (4) completion of a tool requirement (either the passing of a reading knowledge examination in one foreign language or the satisfactory completion of one of the following courses: Math 124, Stat 97, or Stat 160); and (5) either a thesis (Econ 299-300) or 12 semester hours selected from additional third-group economics courses.

Doctor of Philosophy in the field of economics—Required: the general requirements, pages 89–91, 96–99, including (1) Econ 202, 203–4, 205–6, 215–16, 379 or 380, and 24 additional semester hours of approved graduate course work including Econ 275 or 279; (2) passing of the General Examination in microeconomic theory, macroeconomic theory, and two other fields selected by the student and approved by the doctoral program committee; (3) completion of the tool requirement: the passing of a reading knowledge examination in one foreign language, plus the satisfactory completion of Math 124, Stat 197, or Stat 160 (a minimum of six semester hours in approved graduate course work, completed with a grade of *B* or above, in a department other than Economics, is permitted as a substitution for the language reading examination); and (4) a dissertation to demonstrate the candidate's ability to do original research in one of the following fields: econometrics development, economic history, economic policy, economic theory, environmental economics, health economics, history of economic thought, industrial organization, international economics, labor economics, mathematical economics, monetary ecoonomics, national income accounting, natural resources economics, public finance, regional and urban economics, and Soviet economics.

Departmental prerequisite: Econ 1–2 is prerequisite to all other courses in economics except Econ 217–18.

First Group

1–2 Principles of Economics (3–3) Hsieh, Dunn
Lecture (2 hours), discussion (1 hour). Survey of the major economic principles, institutions, and problems in contemporary life. Econ 1: macroeconomics; Econ 2: microeconomics. (Econ 1 and 2—fall and spring)

***91 East Asia—Past and Present** (3) Johnson and Associated Faculty
An interdisciplinary course, introducing the student to a comprehensive and integrated understanding of the civilization and present problems of East Asia.

Second Group

101 Intermediate Microeconomic Theory (3) Yin, Metzger, Fon
Analysis of supply, demand, and pricing. (Fall and spring)

102 Intermediate Macroeconomic Theory (3) Kendrick, Yin
Theories of national income determination and growth. (Fall and spring)

104 History of Economic Thought (3) Hsieh
History of the major schools of economic thought, influence of changing problems on the development of economic theory. Prerequisite: Econ 101, 102.

105 Economic Conditions Analysis and Forecasting (3) Kendrick
Theory and empirical analyses of economic trends and fluctuations; use of economic indicators and simple econometric models. (Fall)

*Interdepartmental course offered by the East Asian Languages and Literatures, Economics, Geography and Regional Science, History, Philosophy, Political Science, and Religion Departments.

121 **Money and Banking** (3) Barth, Marlow
Nature of money, credit, commercial banking, and other financial institutions in the U.S. monetary system. (Fall and spring)

122 **Monetary Theory and Policy** (3) Aschheim, Barth
Analysis of role of money in economic activity in terms of supply of and demand for loanable funds, interest rates and price level. Problems of U.S. monetary policy. Prerequisite: Econ 121. (Spring)

123 **Introduction to Econometrics** (3) Staff
Joint offering of the Economics and Statistics Departments. Construction and testing of economic models: regression theory, parameter estimation, and statistical techniques applicable to economic models. Prerequisite: Econ 101, 102; Math 31 or 41; Stat 111. (Spring)

130 **Comparative Economic Systems** (3) Aschheim
Critical exposition of fundamental economic concepts and theories of capitalism, communism, socialism, and fascism.

133 **Economy of the Soviet Union** (3) Pelzman
Development and main features of economic life in the Soviet Union. (Fall)

134 **Comparative Communist Economic Systems** (3) Pelzman
Analysis of economic development and performance of the Soviet Union and other Soviet-type economies. Institutional aspects and quantitative measures of performance. (Spring)

136 **Natural Resources and Environmental Economics** (3) Yezer
Analysis of market mechanisms for allocating energy and natural resources; cases of market failure in the use of the environment; policies to improve resource allocation using market and regulatory strategies. (Spring)

141 **Women in the Labor Market** (3) Haber
Application of the theory of the household and investment in human capital to female labor force participation, marriage, and family formation; analysis of sex discrimination. (Fall)

142 **Labor Economics** (3) Haber
Analysis of labor supply and demand; measurement and theory of unemployment; occupational choice; wages, prices, and unemployment; poverty and income maintenance. (Spring)

147 **Economic History of Europe** (3) Sharkey
Joint offering of the Economics and History Departments. European economic development since the Middle Ages; emphasis on the period following the Industrial Revolution. Evolution of capitalism and its impact upon the societies of Europe. (Spring)

148 **Health Economics** (3) Scheffler
Analysis of the determination of prices, output, and productivity in the health services sector of the economy.

151 **Economic Development** (3) Wright
Economic problems of underdeveloped nations, with emphasis on economic theories of development and empirical measurement of development problems.

153 **Poverty in America** (3) Yezer
Exploration of social and economic causes of poverty in the United States and evaluation of present and proposed anti-poverty strategies, including comprehensive welfare reform. Discussion of conflicts between sociological and economic models of behavior of low income groups. Same as Soc 153.

157 Urban and Regional Economics (3) **Yezer**
Analysis of the determinants of urban growth and development; firm location; the functioning of urban land and housing markets.

158 Industrial Organization (3) Kwoka
Analysis of the structures and production, pricing, and related practices of industries with emphasis on their significance and on appropriate economic policies. (Spring)

159 Government Regulation of the Economy (3) Staff
Economic analysis of the rationale for effectiveness of government regulation in the American economy. (Spring)

160 Social and Economic Indicators (3) **Staff**

161 Public Finance I (3) **Cordes, Watson**
Theoretical and institutional analysis of government expenditures and intergovernmental fiscal relations. (Fall)

162 Public Finance II (3) **Cordes, Watson**
Theoretical and institutional analysis of tax policy and debt management. (Spring)

165 Economics of Human Resources (3) Stewart
Economic analysis of education and training, information and research, and other contemporary problems. (Fall)

169 Introduction to the Economy of The People's Republic of China (3) Yin
Background, organization, and operation of the economy. Appraisal of performance and analysis of problems of development. (Fall)

170 Introduction to the Economy of Japan (3) **Hadley**
Analysis of the structure and growth of the Japanese economy. (Spring)

179–80 U.S. Economic History (3–3) Sharkey
Joint offering of the Economics and History Departments. Process of economic growth from Colonial times to the present. Development of various sectors in the economy and their interdependence. Econ 179: 1607-1865. Econ 180: 1865 to present. (Academic year)

181–82 International Economics (3–3) Dunn, Pelzman, Anderson
Econ 181: international trade theory and international monetary theory. Econ 182: continuation of international monetary theory; economic development. (Academic year)

185 Economic History and Problems of Latin America (3) Staff
Analysis of present structures and problems of Latin American economies. (Spring)

198 Proseminar in Economics (3) Aschheim, Suranyi-Unger
Examination of major topics in economic theory and the application of theory and analysis to policy problems. Open only to economics majors in their senior year. (Fall and spring)

199 Independent Research in Economics (3) **Staff**
Under the personal direction of an instructor. Limited to economics majors with demonstrated capacity. Prior approval of instructor required. (Fall and spring)

Third Group

Third-group economics courses (except 217–18) are designed for graduate students in economics or for graduate students with prescribed prerequisites.

202 History of Economic Thought (3) Hsieh
Critical analysis and interpretation of the development of economic theory from Plato through the "Keynesian Revolution" and the "Monetarist Counter-revolution." (Fall and spring)

203–4 **Microeconomic Theory** (3–3) Goldfarb, Metzger, Fon
Econ 203: demand, production, cost theory. Prerequisite: Econ 10[illegible] or equivalent. Econ 204: market structure, welfare, general equilibrium. Prerequisite: Econ 203. (Econ 203 and 204—fall and spring)

205 **Macroeconomic Theory I** (3) Barth
Theories of income, employment and the price level; aggregate supply and demand; consumption, saving, investment and the multiplier; supply and demand for money; government's and central bank's role in the economy. (Fall and spring)

206 **Macroeconomic Theory II** (3) Hsieh
Capital and growth theory. Discussion of Cambridge controversy in the theory of capital and one- and two-sector models of economic growth. Other selected advanced topics in macroeconomics. (Fall and spring)

207 **Business Cycle Analysis** (3) Kendrick
Empirical analysis of American business cycles; evaluation of the methodology and findings of the National Bureau of Economic Research. (Spring)

208 **National Income** (3) Kendrick
Theory and measurement of economic aggregates within an integrated national income accounts framework, including balance sheets and wealth statements. (Spring)

210 **Economic Methodology** (3) Stewart
Methodology of economics, review of selected theoretical issues in economic theory. Prerequisite: six semester hours of graduate courses in economic theory. (Spring)

215–16 **Mathematical Economics** (3–3) Fon
Formulation and application of mathematical models in economic theory. Prerequisite: a one-year calculus sequence. Open to undergraduates. (Academic year)

217–18 **Survey of Economics** (3–3) Holman, Suranyi-Unger
For graduate students in fields other than economics. Econ 217: price theory. Econ 218: income and employment theory. Departmental prerequisite waived. (Econ 217 and 218—fall and spring)

223–24 **Monetary Theory and Policy** (3–3) Aschheim, Barth
Theory of monetary policy within the framework of contemporary American central banking. (Academic year)

233 **Seminar: Rural Development Policies** (3) Carroll
Equity and asset redistribution issues in poverty-oriented rural development, stressing new forms of economic peasant associations based on recent experiences and strategies in the LDCs. (Fall)

233 **Seminar: Rural Development Policies** (3) Carroll
Conceptual and empirical review of agrarian systems at various stages of development. Issues in poverty-oriented rural development, agrarian reform strategies, and promotion of rural-urban linkages, stressing peasant income and employment. (Fall)

234 **Seminar: Rural Development Projects** (3) Carroll
Design and evaluation of rural-based investment projects, including multi-sectoral approaches to integrated planning of rural regions, with case studies drawn from the experience of international agencies. Prerequisite: Econ 233 or permission of instructor. (Spring) Staff

235 **Energy Resources and Policy** (3)
Consideration of economic and related policy issues directed at energy problems. (Fall)

236 **Middle East Economics** (3) Staff
Survey of Middle East economics emphasizing the application of economic tools to selected issues of importance.

237 **Economics of the Environment and Natural Resources** (3) Holman
Analysis of public policy problems relating to the environment and natural resources development and management. (Spring)

239 **Economics of Defense** (3) Solomon
Economic issues and analysis pertaining to national security, the defense establishment, and the economy. (Spring)

241–42 **Labor Economics** (3–3) Goldfarb
Theory of wages and employment, analysis of labor supply and demand. Structural unemployment; occupational choice; labor market discrimination. (Academic year)

243 **Seminar: Manpower Policy** (3) Levitan
Developments leading to expansion of public investment in manpower resources; evaluation of goals and operations of publicly supported programs. Open to undergraduates. (Fall)

244 **Economics of Education** (3) Breneman
Returns to investment in education, allocation of resources to and within education, educational financing.

245–46 **Industrial Organization** (3–3) Kwoka
Structure and performance of the American economy; emphasis on the economics of antitrust policy and the impact of government regulatory policies. (Academic year)

247 **Seminar: Industrial Organization** (3) Staff
Selected topics in regulatory economics and in antitrust economics during alternate years. Prerequisite: Econ 101 or equivalent. (Spring)

248 **Health Economics** (3) Scheffler
Demand for medical care; organization of the health care delivery industry; policy issues on regulation, efficiency and allocation of health care services.

251 **Economic Development Theories** (3) Havrylyshyn
Basic theories of economic growth and development. Emphasis on theories inspired by the underdevelopment process. (Fall and spring)

252 **Economic Development Planning** (3) Havrylyshyn
Development planning techniques and practice at both the macro and micro levels. Macro-planning tools analyzed include input/output, multi-sector models, simulation, and linear programming. Micro-planning includes the use of cost-benefit techniques in project analysis. Prerequisite: Econ 251. (Spring)

253 **Productivity Analysis** (3) Kendrick
Concepts, measurement, and analysis of productivity in business and government at aggregate and organizational levels. (Fall)

254 **Economics of Advertising and Information** (3) Tuerck
Theory and empirical analyses of the role of advertising and information in industry structure and performance. (Fall)

255 **Economics of Technological Change** (3) Suranyi-Unger
Economic principles related to determining the proper federal role in influencing civilian-oriented technological change. (Fall)

257 **Regional Economics** (3) Yezer
Analysis of firm location, patterns of interregional or intermetropoli-

tan production, urban and regional growth and patterns of development. (Fall)

258 **Urban Economics** (3) Yezer
Analysis of spatial relationships among economic activities within an urban area including the urban land, labor, and housing markets; urban transportation models; fiscal relationships among jurisdictions. Prerequisite: Econ 257 or permission of instructor. (Spring)

259 **Income Distribution** (3) Stewart, Carroll
Theoretical and empirical analysis of income distribution, including analysis of policies related to income inequality. (Spring)

261 **Welfare Economics** (3) Stewart
Theories of welfare economics and their applications to public policy; analysis of selected topics in public policy. (Fall)

263 **Theory of Public Finance I** (3) Cordes, Watson
Allocation and distribution aspects of government budget policy, including critical analysis of theories and principles of expenditures, and intergovernmental fiscal relations. (Fall)

264 **Theory of Public Finance II** (3) Cordes, Watson
Analysis of the effects of taxation on resource allocation and income distribution; impact of the public debt. (Spring)

265 **Readings in International Taxation** (3) Staff
Examination of topics in economic theory and policy of international taxation: taxation of foreign currency and multinational corporations, tax evasion and tax havens, and tax systems for economic development. (Fall)

267 **Seminar: Soviet Economy** (3) Hardt
Development of the Soviet-type economy. Organization, policies, and problems: monetary, production, allocative, foreign trade, economic growth. Admission by permission of instructor. (Fall)

268 **Seminar: Economic Theory and Development in Communist Countries** (3) Hardt
Appraisal of the Soviet model for economic development in the communist world, especially in Eastern Europe and China. Admission by permission of instructor. (Spring)

269 **Economy of The People's Republic of China I** (3) Yin
Analysis of organization, operation, policies, and problems. Development of the economy since 1949. (Fall)

270 **Economy of The People's Republic of China II** (3) Yin
Continuation of Econ 269, examining critical problems of development. Prerequisite: Econ 269 or permission of instructor. (Spring)

271 **Economy of Japan** (3) Hadley
Analysis of Japanese economic institutions and their contribution to Japan's development. (Fall)

275 **Econometrics I: Introduction** (3) Trost, Link
Single-equation models of economic behavior. Statistical methods for testing economic hypotheses and estimating parameters. Introduction to simultaneous equation problems. Prerequisite: Stat 100 or equivalent, or permission of instructor. Some exposure to matrix algebra is suggested. Same as Stat 275. (Fall and spring)

276 **Econometrics II: Simultaneous-Equation Models** (3) Trost, Link
Economic models and simultaneous-equation systems. Prerequisite: Econ 275. Recommended: a course in matrix theory. Same as Stat 276. (Spring)

279 **Methods in Economic Statistics** (3) Gastwirth
Joint offering of the Economics and Statistics Departments. Applica-

tion of statistical methods of economics. Curve-fitting, regression, analysis of variance, and chi-square techniques used to analyze economic data. Prerequisite: a one-year course in statistics. (Fall and spring)

281–82 **International Economics** (3–3) Dunn, Pelzman
Econ 281: theory of international trade and factor movements. Econ 282: international finance. (Academic year)

285–86 **Economic Development of Latin America** (3–3) Grunwald
Econ 285: diversity of structures of Latin American economies; relevant theories; import substituting industrialization; inflation; problems of underemployment and income distribution. Econ 286: structure of trade; protection, exports, and economic development; regional and global economic integration; foreign investment, multinational enterprise, and technology transfer. (Academic year)

287 **Seminar: Problems in Latin American Civilization** (3) Staff
Same as Anth/Geog/Hist/Rom 287, and PSc 285. Interdisciplinary seminar; each student writes a report on some aspect of a selected key theme. May be repeated for credit. Admission by permission of instructor. (Fall and spring)

290 **Principles of Demography** (3) Boulier
Introduction to basic demographic perspectives and data; methods for analysis of population size, distribution, and composition; determinants and consequences of population trends. Same as Geog/Soc/Stat 290. (Fall)

291 **Methods of Demographic Analysis** (3) Boulier
Basic methods for analysis of mortality, natality, and migration; population estimates and projections; estimation of demographic measures from incomplete data. Same as Geog/Soc/Stat 291. (Spring)

298 **Reading and Research** (3)
Limited to Master's degree candidates. (Fall and spring)

299–300 **Thesis Research** (3–3) Staff
(Fall and spring)

Fourth Group

Fourth-group economics courses are limited to graduate students and are primarily for doctoral candidates. They are offered as the demand requires, and may be repeated for credit with permission of the instructor.

305 **Seminar: Macroeconomics** (3) Staff
Selected topics in macroeconomics. Prerequisite: Econ 205.

312 **Seminar: Price Theory** (3) Staff
Discussion of topics of price theory from recent journal articles.

313 **Seminar: Economic Thought** (3) Hsieh
Continuation of Econ 202. Principal trends in economic thought.

315 **Seminar: Topics in Mathematical Economics** (3) Solomon
Intensive study of selected topics, including economic activity analysis, risk and uncertainty, and other topics of current interest. Prerequisite: Econ 215–16.

321 **Seminar: Monetary Theory** (3) Aschheim, Barth
Recent developments in monetary theory.

341 **Seminar: Labor Economics** (3) Staff
Current problems in theory and policy.

348 **Topics in Health Economics** (3) Scheffler
An in-depth treatment of advanced topics in health economics. Prerequisite: Econ 248 or permission of instructor.

363 Seminar: Public Finance (3) Cordes, Tanzi
Selected topics of current interest.

367 Seminar: Soviet Planning in Theory and Practice (3) Pelzman

378 Seminar: Topics in Econometrics (3) Swamy
Research seminar covering current econometric literature and special topics. Admission by permission of instructor. Same as Stat 378

379–80 Readings in Economic History (3–3) Sharkey
Joint offering of the Economics and History Departments. Econ 379: American economic history. Econ 380: modern European economic history. Prerequisite: the appropriate second-group preparation and consent of instructor. (Academic year)

390 Seminar: International Economic Theory (3) Staff
Limited to graduate students, primarily for doctoral students. Examination of recent contributions in this field.

391 Seminar: International Economic Policy (3) Staff
Topics selected from current significant policy problems.

398 Advanced Reading and Research (arr.) Staff
Limited to students preparing for the Doctor of Philosophy general examination. May be repeated for credit. (Fall and spring)

399 Dissertation Research (arr.) Staff
Limited to Doctor of Philosophy candidates. May be repeated for credit. (Fall and spring)

EDUCATION

Professors R.E. Baker, M.N. Rashid, R. Tillman, A. Marinaccio, L.H. Elliott, L. Nadler, M. Brenner, J.G. Boswell *(Chairman)*, C.E. Vontress, S. Kavruck, M. McIntyre, D.A. Moore, L. Winkler, D. Linkowski, F.J. Brown, E.P. Kulawiec, E.W. Kelly, Jr., S.R. Paratore, R. Ferrante, G.L. Horrworth, E.E. DuBois, E.J. Gleazer, Jr. *(Visiting)*, M. Burns, J.C. Heddesheimer, G.W. Smith, C.S. Tidball
Adjunct Professor R.C. Rist
Professorial Lecturers D. Iwamoto, A.C. Jensen, D.D. Darland
Associate Professors R.I. Peterson, G.D. Wiggs, J.A. Greenberg, J.D. Fife, S.A. Wyman, A.P. Kowalski *(Research)*, D.H. Holmes
Associate Professorial Lecturer T.R. Howie
Assistant Professors R.A. Luke, E.R. Lilly
Assistant Professorial Lecturers M.R. Phelps, P. Callas, E. Zuniga, C.H. Hoare, S.S. Beck
Instructors C.B. Stapp, P. Finnerty-Fried
Lecturer L. Donnels

Programs of study leading to the degrees of *Bachelor of Arts in Education and Human Development, Master of Arts in Education and Human Development, Master of Arts in Teaching, Education Specialist,* and *Doctor of Education* are offered by the School of Education and Human Development (see pages 101–31).

Second Group
Educ 136, 137, 138, 139, 140, 144, and 146 are special methods courses which are to be elected in the senior year by students in the secondary school curriculum after substantial preparation in the teaching fields concerned. Course requirements and hours of credit vary with license requirements. Prerequisite to all special methods courses: Educ 104, 105 for elementary majors; Educ 131 for secondary majors.

100 Special Workshop in Education and Human Development (arr.) **Staff**
Topics to be announced in the *Schedule of Classes*. May be repeated for credit. (Fall and spring)

101 Introduction to Education and Human Services (3) Boswell and Staff
The scope of education and human services is defined from historical, philosophical, and cross-cultural perspectives. Field trips and guest speakers. (Fall and spring)

102 Introduction to Human Development I (3) McIntyre
Lectures and field work. All aspects of development through adolescence; child study techniques. Two to three hours weekly field experience in appropriate setting. (Fall and spring)

103 Introduction to Human Development II (3) Staff
Lectures and field work experiences. Development from young adulthood on. (Fall and spring)

104 Psychology for Learning and Teaching (3) Staff
Principles, theory, nature, and course of learning and teaching processes. Examination and analysis of the strategies and dynamics of teaching and learning in behavioral settings. Three-hour fieldwork sessions. (Fall and spring)

105 Social Issues in Education and Human Services (3) Boswell and Staff
Historical and social development of education and human services, contemporary issues, interrelationship of educational and human service institutions, policy considerations and future issues. Prerequisite: Educ 101 or permission of instructor. (Fall and spring)

110 Elementary School Teaching of Reading (3) Horrworth
Introduction to methods, techniques, materials, and activities essential to a good elementary school reading program. Prerequisite: Educ 104 and 105 or teaching experience.

111 Elementary School Curriculum and Methods (15) Moore and Staff
Diagnostic reading, mainstreaming, mathematics, science, language arts, social studies, music, art, physical education. Pre-student teaching one and one-half days a week. Prerequisite: Educ 102, 103, 104, 105; and senior standing. (Fall)

112 Measurement and Evaluation (3) Staff
Basic evaluative measurement techniques: selection, administration and interpretation of standardized tests; test construction, evaluation procedures, statistical analysis. (Fall and spring)

113 Elementary School Art (3) **Staff**
Lecture and laboratory (3 hours), field work—as arranged. For undergraduates in the elementary school curriculum. Materials and methods. Material fee, $5. (Spring)

118 Elementary Reading: Classroom Diagnosis and Instruction (3) Horrworth
Emphasis on diagnostic procedure aimed at individualizing and improving classroom instruction. Prerequisite: Educ 110 or equivalent. (Fall and spring)

120 Experimental Course in Education and Human Development (arr.) Staff
Topic to be announced in the *Schedule of Classes*. May be repeated for credit provided the topic differs.

121 International Experiences (1 to 6) Staff
Travel to a foreign country for study of a specific topic.

124 **Communication Skills** (3) Brenner
Theory and practice in the development of professional relationships and communications: teacher-student, museum-school, group strategies. The interview.

125 **Museums as Cultural and Educational Resources** (3) Staff
Use of the museum for knowledge and enjoyment; museum objects as primary sources; meetings in D.C.-area art, history, and science museums.

128 **Children's Literature** (3) McIntyre
Lectures, discussion, and field work. Classics as well as newer books for children and youth are explored. Significant authors and illustrators are highlighted. (Spring)

129 **Critical Social Issues in Literature for Children and Youth** (3) Staff
Content evaluation of books, including issues such as ethnicity, sexism, family problems, handicapping conditions, death, and the role of fantasy versus realism. (Summer)

131 **Secondary School Principles and Methods** (3) Kulawiec
For seniors. Classroom management and teaching techniques for initiating, guiding, and evaluating learning activities. Group-work to be arranged. Prerequisite: Educ 104 and 105. (Fall)

132 **Student Teaching in Early Childhood Schools** (3 or 6) McIntyre
For seniors. Supervised teaching in selected prekindergarten or kindergarten class in accredited school; seminar. Admission by permission of instructor. Prerequisite: Educ 111 or equivalent; Educ 150, 152, 153, 154. (Fall and spring)

133 **Supervised Experience in Education and Human Development Services** (3 to 6) Staff
Field work, internship, and instructional practice: (1) adult education and human resource development (Wiggs); (2) college student development experience (Burns); (3) higher education (Greenberg); (4) museum education (Nashman); 5) counseling (Heddesheimer). Admission by permission of instructor. (Fall and spring)

134 **Student Teaching in Secondary Schools** (6 to 9) Kulawiec and Staff
For seniors. Admission by permission of instructor. Prerequisite: Educ 131. (Fall and spring)

135 **Student Teaching in Elementary Schools** (6 or 9) Moore and Staff
For seniors. Admission by permission of instructor. Prerequisite: Educ 111 or equivalent. (Fall and spring)

136 **Teaching English in Secondary Schools** (3) Staff
Lecture (2 hours), field work (2 hours). Prerequisite: 18 semester hours in English. (Spring)

137 **Teaching Speech** (3) Staff
Lecture (2 hours), field work (2 hours). Prerequisite: 18 semester hours in speech or permission of instructor. (Spring)

138 **Teaching Social Studies in Secondary Schools** (3) Staff
Lecture (2 hours), field work (2 hours). Prerequisite: 24 semester hours of social studies. (Spring)

139 **Teaching Art in Secondary Schools** (3) Staff
Lecture (2 hours), laboratory (2 hours). Prerequisite: 24 semester hours of Art. Material fee, $5. (Spring)

140 **Teaching Mathematics in Secondary Schools** (3)
Lecture (2 hours), field work (2 hours). Prerequisite: mathematics through calculus. (Spring)

144 **Teaching Science in Secondary Schools** (3) Kulawiec
Lecture (2 hours), field work (2 hours). Prerequisite: 24 semester hours of science. (Spring)

146 **Teaching Foreign Languages** (3) Kulawiec
Lecture (2 hours), field work (2 hours). Prerequisite: 18 semester hours of one foreign language. (Spring)

150 **Foundations of Early Childhood Education** (3) McIntyre
Historical development, philosophy, and objectives of nursery schools, kindergartens, and day care; exploration of contemporary programs and models with curriculum implications for schools in the U.S. and abroad. Admission by permission of instructor. (Fall)

152 **Early Childhood Curriculum** (3) McIntyre
Rationale, development, content approaches, programs, and materials in language arts, mathematics, science, health, social studies, and aesthetic education. Admission by permission of instructor. (Fall)

153 **Role of the Professional in Early Childhood Education** (3) McIntyre
Planning, reporting, records, teacher-child and teacher-family interaction, diagnosis and evaluation, working with paraprofessionals and parents. Emphasis on total classroom ecology. Admission by permission of instructor. (Spring)

154 **Community Resources and Materials for the Young Child** (3) McIntyre
Interaction with community agencies and resources for services; equipment, play activities, curriculum materials, and methods for teaching the infant and young child. Admission by permission of instructor. (Spring)

161 **Human Development** (3) Rashid
Consideration of human development and behavior throughout the life span; emphasis on practical implications of relevant interdisciplinary research. (Fall and spring)

162 **Foundations of Counseling** (3) Heddesheimer, Winkler
Introductory survey: definitions, scope, principles, historical background, organization, services, emerging trends, and issues. (Fall and spring)

163 **Personal and Social Adjustment** (3) Winkler
Mental health problems; emphasis on needs of counselors, teachers, and others working with children and adolescents. (Fall and spring)

171–72 **International Education** (3–3) Moore
Survey of selected foreign educational systems and cultures. Research, techniques, and materials to develop world-mindedness. Embassy resources utilized. (Summer)

173 **Comparative Education** (3) Kulawiec
A systematic investigation of the educational structure and practices of selected representative school systems throughout the world. Emphasis on development of a methodology for comparative study. (Fall)

178 **Designing and Implementing Conferences and Meetings** (3) Nadler
Same as HKLS 178. Use of design committees, steering committees, selection of resource people, site selection, exhibits, and relation to supplier personnel. Special attention to designing the core of the conference, and related conference activities. (Fall)

187–88 **Sign Language and Deafness** (3–3) Donnels and Staff
Basic expressive and receptive skills in sign language of the deaf.

Discussion of issues and implications of deafness. Same as HKLS/SpEd 187–88.

193–94 **Research and Independent Study** (arr.) **Staff**
Individual research under guidance of a staff member. (Academic year)

Third Group

Departmental prerequisite: A degree from an accredited institution is prerequisite to all third-group courses in education. Adequate professional preparation is prerequisite to all third-group courses in education except for those courses limited to students in the M.A.T. degree program. Undergraduate students in their senior year may enroll in third-group courses with permission from the instructor.

200 **Special Workshop in Education and Human Development** (arr.)
Topics to be announced in *Schedule of Classes*. May be repeated for credit.

201–2 **International Education** (3–3) **Moore**
A study of a selected sample of foreign education systems as they reflect culture, values, people, and current changes in the world today. Research techniques and materials to develop a global frame of reference. Foreign resources utilized. (Summer)

203–4 **Comparative Education** (3–3) Kulawiec
A systematic investigation of the educational structure and practices of selected representative school systems throughout the world. Emphasis on development of a methodology for comparative study. (Academic year)

205 **Foundations of Curriculum Development** (3) **Tillman**
For experienced teachers. Curriculum research and design, issues and trends, comparison of curriculum patterns, curriculum development in subject areas, and group consideration of current field-related problems. (Fall and spring)

207 **Instructional Materials, Media, and Resources** (3 to 6) **Tillman**
(Formerly Curriculum Design: Procedures and Materials Organization)
Review of technological contributions to education. Examination of current and emerging developments. Framework for study of selection, utilization, integration, and evaluation of audio-visual media in the teaching/learning process.

208 **Human Development** (3) **Rashid**
Consideration of human development and behavior throughout the life span; emphasis on practical implications of relevant interdisciplinary research. (Fall and spring)

209 **Child Development** (3) **Rashid**
Interdisciplinary approach to child development and behavior. Practical implications of research in disciplines contributing to knowledge about childhood. (Fall)

210 **Adolescent Development** (3) **Rashid**
Interdisciplinary approach to adolescent development and behavior. Practical implications of research in disciplines contributing to knowledge about adolescence. (Spring)

212 **Quantitative Methods I: Introduction to Survey Measurement and Research** (3) Kavruck, Smith, and Staff
Introduction to measurement techniques and evaluation. Emphasis on application and interpretation of data gathering techniques and descriptive statistics.

213–14 **Western Educational Thought** (3–3) Boswell, Darland
Following the themes of certainty, equality, and progress, this course examines the ideas of selected philosophers in their historical context, and relates them to education. Educ 213: From Sumer to the Enlightenment; Educ 214: From the Enlightenment to the present with concentration on the American experience. (Fall and spring)

215 **Practicum for the Gifted** (3 or 6) Rashid, McIntyre
A culminating supervised experience in a variety of settings for students in the M.A. program for the gifted. Admission by permission of the instructor.

216 **Advanced Study of the History of Education** (3) Boswell, Darland
Individually planned program of study on topic of student's interest. Prerequisite: Educ 213–14 or the equivalent.

217 **Advanced Study of the Philosophy of Education** (3) Boswell, Darland
Individually planned program of study on topic of student's interest. Prerequisite: Educ 213–14 or the equivalent.

218 **Social Foundations of Education** (3) Kulawiec
Forces that shape policies and offerings of the school.

219 **Theory and Practice of Classroom Teaching** (3) Baker
Current theories of teaching and learning and their application to strategies of classroom teachers. (Summer)

220 **Experimental Course in Education and Human Development** (arr.) Staff
Topic to be announced in the *Schedule of Classes*. May be repeated for credit provided the topic differs.

221 **International Experiences** (1 to 6) Staff
Travel to a foreign country for specific study and research. Admission by permission of the instructor.

222 **Foundations of Reading Instruction—Early Childhood and Elementary School** (3) Horrworth
Linguistic, historical, sociological, and psychological foundations of reading instruction; study and discussion of widely used approaches, methods, and materials for teaching reading; collection and preparation of specific activities for teaching the various pre-reading and reading skills; demonstrations of classroom instructional techniques. (Fall)

223 **Foundations of Reading Instruction in Content Areas—Intermediate and Secondary School** (3) Horrworth
Brief overview of historical, linguistic, and psychological foundations; need for teaching reading in content fields; emphasis on basic instructional methods and techniques; teaching demonstrations of basic reading and study skills in content subjects; study of "readability" of content materials; research and application of formulas. (Fall)

224 **Diagnostic Teaching of Reading—Early Childhood and Elementary School** (3) Horrworth
Classroom diagnostic techniques for elementary teachers; construction of informal tests; administration, scoring, and interpretation of informal and standardized tests as well as other measures of evaluation; study of materials; selecting and planning activities suitable for correction of specific problems. Prerequisite: at least one previous course in reading. (Spring)

226 **Diagnostic Teaching of Reading in Secondary School** (3) Horrworth
Extension of instructional strategies and techniques in Educ 223; construction of informal tests; administration, scoring, and interpretation of informal and standardized tests; study and evaluation of materials and teaching procedures; application of readability formulas; class demonstrations of teaching strategies. Admission by permission of instructor. (Spring)

227 **Basic Issues in Elementary Education** (3) Baker
Identification, definition, and analysis of some of the most important problems facing the contemporary American elementary school. (Fall)

228 **Instructional Areas in Elementary Education** (3) Baker
Current trends and research in reading, language arts, social studies, mathematics, science, music, art, and physical education. (Spring)

234 **Organization for Personalized Learning in the Open Classroom** (3) Horrworth
Practical application of individualized instruction theories and methods through design, development, implementation, and revision of elementary and secondary level self-instructional packages.

235 **Analysis of Teaching** (3) Boswell, Ferrante
Teaching as work: diagnosing learning skills, program planning and implementation, feedback information on both student and program. (Fall)

236 **Technical Programs in Human Resource Development** (3) Wiggs
(Formerly Introduction to Education Technology)
Analysis of the nature and scope of human resource development technical training in industry, government organizations, and labor unions. (Spring)

237 **Designing Technical Training Programs** (3) Wiggs
(Formerly Systems Approach to Instructional Design)
Applications of behaviorist design models for curriculum and methodological strategies in technical skills training programs. (Summer)

239 **International Programs in Adult Learning** (3) Staff
The use of adult learning programs (adult education, human resource development, higher education, etc.), in various parts of the world, as provided by international agencies, multi-national companies, and public foundations. Emphasis on national development, social problems, economic growth.

241 **Education of the Gifted and Talented** (3) Rashid
Nature and discovery of giftedness, provision for the gifted in educational settings. Research findings and issues. (Summer)

242 **Fundamentals of Educational Administration** (3) Brown
(Formerly The Teacher and School Administration)
Organization, structure, and governance of public education; federal, state, and local responsibilities. Basic administrative/leadership theory. Roles and functions of school administrators.

243 **Human Relations in Education and Management** (3) Marinaccio
Principles and practices in human relations between and among learner, teacher, other school personnel, parents, and community.

245 **School and Community** (3) Marinaccio
The school as an important member of a team of social agencies that builds the community.

246 **Administrative Issues in Urban Education** (3) Lilly
Administrative strategies and practices appropriate to problems of urban schools.

247 **Post-Secondary Career Education** (3) Greenberg
Development, current concepts, agencies involved, problems, and trends in vocational, technical, and occupational education in the United States, with emphasis on the community college. (Spring)

248 **Supervision of Instruction** (3) Tillman, Brenner
Study of interdisciplinary foundations of supervision. Special attention to the function of theory, change, individual and group relationships in organizations, staff influence processes, talent utilization, and evaluation of programs and staff. (Fall)

249 **Drug Treatment and Resources** (3) Staff
Individual, social, and cultural factors related to drug abuse and its treatment.

250 **Counseling Drug Abusers** (3) Staff
Crisis intervention, self-help groups, family therapy; individual and group counseling applied to drug abusers.

251 **Foundations of Counseling** (3) Heddesheimer, Winkler
Introductory survey: definitions, scope, principles, historical background, organization, services, emerging trends, and issues. (Fall and spring)

252 **Organization and Administration of Counseling Services** (3) Vontress
Principles and procedures for designing and implementing counseling services. Admission by permission of instructor. (Spring)

253 **Individual Appraisal in Counseling** (3) Winkler
Detailed study of individual analysis and appraisal techniques. Development of systematic case study. Prerequisite: Educ 112 or equivalent. (Fall and spring)

254 **The Middle School** (3) Kulawiec
Development, organization, and practices; emphasis on the learner, the teacher, the administrator, the curriculum, and the setting of the school for the preadolescent. (Fall)

255–56 **Secondary Education** (3–3) Kulawiec
Examination of historical, psychological, sociological, and philosophical bases; emphasis on prescriptive implications. Special attention to contemporary problems and practices. (Alternate academic years)

257 **Career Development and Information** (3) Vontress
Theories of career development; factors influencing the world of work; procedures for evaluating and using socio-personal, educational, and occupational information. (Fall and spring)

258 **Theories and Techniques of Counseling** (3) Heddesheimer, Vontress
Theories and practices of counseling. Prerequisite: 12 semester hours in counseling, including Educ 253 and 257. (Fall and spring)

259 **The Principalship, K-12** (3) Lilly
A general introduction to the principalship. Administrative tasks and procedures are stressed, together with the principal's role in handling educational issues and problems. Prerequisite: Educ 242.

280 **Supervision in the Elementary and Secondary School** (3) Tillman, Brenner
For experienced teachers and administrators. Review of modern supervisory concepts, including practices in schools. (Spring)

261 **Practicum in Counseling and Human Development** (3) — Rashid and Staff
Separate sections offered for counseling majors and human development majors. Prerequisite: Educ 258 or permission of instructor. (Fall and spring)

262 **Internship in Counseling and Human Development** (3) — Rashid and Staff
Separate sections offered for counseling majors and human development majors. Admission by permission of instructor. (Spring)

263 **Human Resource Development: Training and Education** (3) — Nadler, Luke, Wiggs
Concepts and purpose, historical backgrounds, roles of human resource development personnel, program areas. Prerequisite: adequate professional preparation or experience in training, education, and development. (Fall)

264 **Design of Training Programs in Human Resource Development** (3) — Nadler, Luke
Training, education, and development programs for various client systems will be planned using critical-events conceptual model. Field work. Prerequisite: Educ 263 and permission of instructor. (Spring)

265 **Futurism and Education** (3) — Kulawiec
Contemporary view of the future through readings, discussion, simulation, games, and films. Impact of technology on humans and the environment. Future shock, alternative futures, overchoice. (Summer)

267 **Human Sexuality for Counselors** (3) — Winkler
The purpose of this course is to increase the awareness and understanding of sexuality as it relates to counseling in contemporary society.

268 **Family Counseling** (3) — Winkler
The family as a system: how it affects the client and how the client affects it. Didactic presentations, role-playing, and work with simulated families. (Spring)

269–70 **School Business Management** (3–3) — Brown
Educ 269: Philosophy, responsibilities, and functions of school business management. Educ 270: Practicum in school business management. Educ 269 is prerequisite to Educ 270. (Academic year)

271 **Policy Making for Public Education** (3) — Boswell, Ferrante
The nature of educational policy: the role of single-interest groups, the courts, legislative bodies, administrative bureaucracies, and professionals in establishing parameters and allocating resources. Analysis of specific techniques of policy formation. (Summer)

272 **Educational Planning** (3) — Zuniga
An examination of the planning movement in education: its historical development and the recent shift in premises, context, and expectations. Different approaches to the planning process; its relationship to the concepts of systems and futurism; participatory, sectorial, and regional aspects; role of research, and overview of main analytical techniques currently in use. (Fall)

273 **Pre-Service Teacher Education** (3) — Boswell
Program development, governance, issues, trends. (Fall, alternate years)

274 **In-Service Teacher Education** (3) — Boswell
Continuing professional development of educators, costs and bene-

fits to society, promising programs and practices, current issues. (Spring, alternate years)

275 **School Finance** (3) Brown
Issues in financial support of public education. Local, state, and federal roles. Budget development and administration.

276 **Public Relations in School Administration** (3) Brown
The function, purposes, and resources of school public relations. Development of skills in planning public relations programs and activities. Theory and practice of effective communication.

277 **Dynamics of Change in Education** (3) Boswell
An analysis of the process of cultural change in Western society, with emphasis on education. Comparison of theories; analytical tools; historical precedents; the contemporary situation, prospects for the future.

278 **School Law** (3) Lilly
Constitutional and statutory provisions for public school education: origin and legal status of the local school unit; nature of the school board; legal status of teachers and administrators; legal rights and responsibilities of parents and pupils. (Spring)

279 **Adult Education** (3) Wiggs
Current concepts and objectives, historical development, agencies involved, personnel, clients, programs on all levels—community through international. (Fall)

280 **Program Planning** (3) Wiggs, Luke
Determining educational needs for adults in school and non-school agencies; designing programs and instruction; budgeting and scheduling of adult programs. Field work with sponsoring agency. Prerequisite: Educ 279 and permission of instructor. (Spring)

281 **Program Evaluation: Theory and Practice** (3) Holmes
A general introduction to the theory of evaluation of social programs. Overview of evaluation models, methodology associated with program evaluation, and examination of evaluation in the context of political and social environments. (Fall and spring)

282 **Introduction to Qualitative Research Methods** (3) Rist
A general introduction to qualitative research procedures in social science research. Application of qualitative methods, design, analysis. (Fall and spring)

283 **Higher Education in the United States** (3) Burns
History, scope, purpose, present status, programs, and trends in higher education in the United States. (Fall and spring)

284 **Administration of Higher Education** (3) Marinaccio
Government, organization, and administration of colleges and universities; duties of trustees and administrators. (Fall and spring)

287–88 **Clinical Study of Reading Problems** (3–3) Peterson
For advanced students. Diagnostic and corrective work under supervision. Complete case study approach; selection and evaluation of diagnostic and instructional materials and techniques for permanent file. Prerequisite: Educ 222 and 223, or 224 and 226. Material fee $10 per semester. (Academic year)

289 **Organization and Administration of Reading Programs** (3) Peterson
For principals, assistant principals, supervisors, superintendents and reading teachers. Problems in planning, reorganizing and improving the total reading program. (Fall and summer)

290 **Severe Learning Disabilities in Reading** (3) Peterson
For experienced teachers. Case studies of children and/or adults with severe reading problems, planning and implementing instructional programs. Admission by permission of instructor. Material fee, $10. (Spring)

291 **Educational Facilities Planning** (3) Brown
Principles of school plant planning; site selection; evaluation of existing buildings; utilization of present facilities; adaptation to curricular needs; building operation; and maintenance problems (Fall)

292 **Practicum in Program Evaluation** (3 to 6) Holmes
Supervised practical experience in field placements. Admission by permission of instructor. (Fall and spring)

293–94 **Research and Independent Study** (3–3) Staff
Individual research under guidance of a staff member. Program and conferences arranged with an instructor. (Academic year)

295 **Quantitative Methods II: Research Procedures** (3) Paratore, Smith, Holmes
Required of all candidates for masters' degrees in education. Analysis of scientific approaches to problems in education; evaluation of research techniques. Prerequisite: Educ 112, 212; or equivalent. (Fall and spring)

297 **Personnel Administration** (3) Brown
Organization and administration of personnel programs for educational institutions. Basic philosophy, principles, responsibilities, and functions; current issues. (Spring)

299–300 **Thesis Research** (3–3) Staff
Required of M.A. in Ed. degree candidates writing master's theses (Fall and spring)

302 **Quantitative Methods III: Inferential Techniques** (3) Holmes, Paratore, Smith
Educ 302 or Stat 105 is required of all doctoral students in education. Prerequisite: Educ 212 or a basic statistics course and permission of instructor. (Fall and spring)

303 **Data Analysis** (3) Staff
Use of computer in data analysis. For doctoral students at the dissertation-planning stage. (Fall and spring)

304 **Practicum in Supervision** (3 to 6) Tillman, Lilly
Practical experience in supervision of instruction. Admission by permission of instructor.

305 **Internship: Supervision** (3 to 6) Tillman, Lilly
Service in a school situation directed by the University's faculty and school systems; integration of theory and practice.

306 **Quantitative Methods IV: Advanced Research Design** (3) Holmes, Paratore, Smith
Required of all doctoral students in education. Evaluation and application of educational research designs. Prerequisite: Educ 302 or equivalent. (Fall and spring)

310 **Museum Studies** (3) Stapp
Study of the museum's functions and its educational roles. Admission by permission of instructor.

311 **Museum Audiences** (3) Brenner
Study of the many audiences of many ages who use and enjoy museums; appropriate museum practices, proposal writing.

312 **Internship in Museum Education** (6) Stapp
Four-day-a-week placement in education departments in area museums. Supervision and seminar are provided by George Washington University faculty. Admission by permission of instructor.

316 **Recent Developments in Elementary School Social Studies** (3) Moore
For experienced educational personnel. Research, techniques, materials, and innovative programs relating to the effective elementary school social studies curriculum. Admission by permission of instructor.

317 **Recent Developments in Elementary School Science** (3) Staff
For experienced educational personnel. Research, techniques, materials, and innovative programs relating to the effective elementary school science curriculum. Admission by permission of instructor.

320 **Recent Developments in Elementary School Mathematics** (3) Staff
For experienced educational personnel. Research, techniques, materials, and innovative programs relating to the effective elementary school mathematics curriculum. Admission by permission of instructor. (Spring)

321 **Practicum in Curriculum** (3 to 6) Staff
Supervised field experience in curriculum. Admission by permission of instructor. (Fall and spring)

322 **Internship: Reading** (3 to 6) Peterson
Limited to doctoral students in education. Experience in a selected area of college teaching. (Fall and spring)

323 **Internship: Reading** (3 to 6) Peterson
Limited to doctoral students in education. Service in a school situation directed by the University's faculty and school systems; integration of theory and practice. (Fall and spring)

324 **Teaching Reading and Study Skills at the College Level** (3) Peterson
Evaluation of reading skills at the college level. Development of college reading programs, including diagnostic and teaching techniques, program planning and implementation. Prerequisite: Educ 226 or equivalent, and permission of instructor. (Spring)

325 **Curriculum Theory** (3) Tillman
Examination of reviews and research studies in curriculum theory. Focus on trends, values, interpretations, fads, design systems, and evaluation. (Spring)

328 **Selected Topics in International Education** (3) Moore

329 **Seminar in Program Evaluation** (3) Holmes
Contemporary problems and issues in evaluation of social programs: design, implementation, analysis, and utilization. (Spring)

330 **Foundations of Early Childhood Education** (3) McIntyre
Historical developments, philosophy and objectives of nursery schools, kindergartens and day care centers; exploration of contemporary programs and models with curriculum implications for schools in the United States and abroad. (Fall)

332 **Early Childhood Curriculum** (3) McIntyre
Rationale, development, content, approaches, programs, and materials in language arts, mathematics, science, health, social studies, and aesthetic education. (Fall)

333 Role of the Professional in Early Childhood Education (3) McIntyre
Planning, reporting, maintaining records, teacher-child and teacher-family interaction, diagnosis and evaluations, working with paraprofessionals and parents. Emphasis on total classroom ecology (Spring)

334 Community Resources and Materials for the Young Child (3) McIntyre
Interaction with community agencies for services, resources, and equipment; physical facilities, play activities, curriculum materials and methods for teaching the infant and young child. (Spring)

335 Practicum in Early Childhood Education (3 to 6) McIntyre
Supervised professional activity in selected early childhood programs; seminar. Prerequisite: 12 semester hours in early childhood education and permission of instructor. (Fall and spring)

336 Clinical Practicum in Reading (3) Horrworth
Supervised clinical experience in testing and teaching. Approximately 120 class hours required. Admission by permission of instructor. (Fall and spring)

341 Cognitive Models and Instruction (3) Rashid
Cognitive models (Guilford, Bruner, etc.) are analyzed as the theoretical basis for planning instructional episodes appropriate at various levels—childhood through adulthood. (Fall)

342 Language Development (3) Rashid
Nature of language acquisition and development; emphasis on sociolinguistics and psycholinguistics most pertinent to education. (Spring)

343 Advanced Studies in Human Development (3) Rashid
Review and consideration of empirical research studies on selected topics in human development. Issues, instrumentation and research needs in respect to each topic discussed. Admission by permission of the instructor. (Spring)

344 Adult Development and Aging (3) Rashid
Theories and research on personality and cognition in adulthood and old age. Emphasis on evaluating research designs and methods, and deriving implications of findings for gerontological programs and selected professional roles.

353 Counseling Older Persons (3) Staff
Special considerations and counseling emphases in regard to second careers, retirement adjustments, death and dying. (Spring)

354 Cross-Cultural Counseling (3) Vontress
Problems of and procedures for counseling culturally different clients. Emphasis on counseling cultural minorities in the United States. (Spring and summer)

355 Counseling in Groups (3) Heddesheimer, Winkler
Principles of group dynamics as related to interaction within groups. Techniques and practice in group counseling. (Fall and spring)

356 Counseling and the Disciplines (3) Staff
For advanced students in counseling. Explores the psychological, sociological, economic, anthropological, and philosophical foundations of counseling. Admission by permission of instructor.

357 Personal and Social Adjustment (3) Winkler
Mental health problems; emphasis on needs of counselors, teachers, and others working with children and adolescents. (Fall and spring)

358 **Advanced Theories of Counseling** (3) Vontress
Critical analysis and evaluation of leading counseling theories and consideration of their implications for practice. Intended for Education Specialist and Doctor of Education degree candidates whose area of concentration is counseling. Admission by permission of instructor. (Fall)

360 **Job Development and Placement** (3) Finnerty-Fried
Job development and modification, and placement of disabled persons. (Spring)

361 **Medical Aspects of Rehabilitation** (3) Finnerty-Fried
Chronic and traumatic disorders with rehabilitation implications. (Fall)

362 **Client Evaluation in Rehabilitation** (3) Finnerty-Fried
Vocational planning through work-sample assessment, testing, interview, and observation. Prerequisite: Educ 212 or equivalent. (Spring)

363 **Psychosocial Aspects of Rehabilitation** (3) Linkowski
Impact of disabilities and concept of normalization. (Fall)

364 **Administration and Governance of Two-Year Colleges** (3) Greenberg
A study of the community junior college, focusing on administrative patterns and national, regional, state, and local influences, as well as the theory and structure of two-year college organization. (Fall and spring)

365 **Foundations of Rehabilitation** (3) Finnerty-Fried
Survey of history, philosophy, legislation, roles and services. Visits to selected field sites. (Fall)

366 **Field Work in Rehabilitation Counseling** (3) Finnerty-Fried
Field work of two full days a week; concurrent seminar. (Spring)

367–68 **Internship: Rehabilitation Counseling** (3–3) Linkowski, Finnerty-Fried
Supervised practice of three full days a week; concurrent seminar. Prerequisite: Educ 366. (Academic year)

369 **Professional Issues in Rehabilitation** (3) Linkowski, Finnerty-Fried
Seminar covering professional problems and ethical issues. Prerequisite: Educ 367. (Spring)

370 **College Students and Their Community** (3) Burns
Survey of literature on the characteristics, behavior, and attitudes of the contemporary college student; college students' interaction with their environment. Admission by permission of instructor. (Fall)

372 **Internship in Adult Learning** (3 to 6) Greenberg
Supervised experience in a selected area of college teaching. Prerequisite: Educ 371. Admission by permission of instructor. (Spring)

373 **The Community-Junior College** (3) Gleazer, Greenberg
The two-year college as it relates to secondary education, four-year colleges, and universities. Objectives, curricula, students, faculty, legal concerns, and special problems of two-year colleges. (Fall and spring)

374 **Current Issues in Higher Education** (3) Elliott, Marinaccio
Prerequisite: Educ 283, 284. (Spring)

375 **Foundations of College Student Development** (3) Burns
College student development as an integral part of higher education programs. (Fall)

376 **Group Theories and Techniques** (3) Burns
Focus on theorists including Argyris, Blaw, Miles, Festinger, and Lewin, and practical application of theories to various organizational settings and individuals. Prerequisite: permission of instructor. (Spring)

377 **Practicum in College Student Development** (3 to 6) Burns
Supervised practical experience in college student development programs. Admission by permission of instructor. (Fall and spring)

378 **Practicum in Teacher Education** (3 to 6) Brenner, Boswell
For selected experienced teachers. Supervised field work relevant to students' professional needs, to be arranged. (Fall and spring)

379 **Practicum in Adult Learning Programs** (3 to 6) Nadler
Supervised practical experience in various forms of adult education and human resource development. Admission by permission of instructor. (Fall and spring)

381 **Adult Learning** (3) Luke, Wiggs
Learning theories as applied to adults in individual and group learning transactions; effect of age on learning; psychological, physical and social environment in adult education situations. (Fall and spring)

382 **Instructional Strategies in Adult Learning Programs** (3) Luke, Greenberg
Methods, techniques, and devices for adult learning; developing action-oriented learning situations in adult learning programs. (Spring)

383 **Interviewing-Counseling for Human Resource Developers** (3) Wiggs
Applications of interviewing, coaching and counseling skills for the human resource development specialist and others in various occupational settings. (Fall)

384 **Evaluation of Adult Learning Programs** (3) Wiggs, Luke
Evaluation design strategies for adult learning programs in business, industry, government, voluntary and community organizations, and agencies. (Fall)

385 **Collective Negotiations in Higher Education** (3) Fife
Theory, practice, problems, and issues in collective negotiations in higher education.

386 **Current Issues in Adult Learning Programs** (3) Staff
For M.A. in Ed. degree candidates. Current issues and trends in the fields of adult education and human resource development. Admission of others by permission of instructor. (Spring)

387 **Administration of Adult Learning Programs** (3) Staff
Program administration in school and non-school agencies, staff recruitment and development, fiscal operations, facilities, and maintenance of effective community relations. (Fall)

388 **Case Studies in Higher Education Administration** (3) Marinaccio
Limited to advanced doctoral students in education. Analysis of selected hypothetical cases related to essential administrative functions of colleges and universities. Admission by permission of instructor. Luke

389 **Consultant-Client Relationships in Human Resource Development** (3)
Examination of the consulting process, consultant-client behaviors, and dilemmas using theory and field experience for individual and

organizational development. Prerequisite: Educ 264, 280; or approval of instructor. (Fall and spring)

390 **Legal Problems in Higher Education** (3) Fife
Investigation of legal problems in higher education related to the legal structure of higher education, religious concerns, students, faculty, and academic programs. (Spring)

391 **College and University Curriculum** (3) Greenburg, Fife
Development, patterns, creative design, issues, problems, evaluation, and trends in the higher education curriculum. (Fall)

392 **Financing Higher Education** (3) Staff
Analysis of private, state, and federal revenue sources; student aid, program budgets, and financial methods and practices. (Spring)

393 **Practicum in Higher Education** (3 to 6) Greenberg, Burns
Supervised field experiences in higher education; reports and conferences. Admission by permission of instructor. (Fall and spring)

394 **College and University Governance** (3) Marinaccio
Organizational and administrative structures, patterns, and relationships in higher education. Prerequisite: Educ 284. (Fall)

395 **Problems and Practices in Educational Administrative Organization** (3 to 6) Marinaccio
Application of principles and practices concerned with change and evaluation of educational administration.

396 **Internship: Higher Education Administration** (3 to 6) Marinaccio, Greenberg
Service in a higher education situation directed by the University and the cooperating institution to integrate theory and practice. (Fall and spring)

397 **Internship: Administration** (3 to 6) Staff
Service in an educational institution or education-related program directed by the University's faculty. (Fall and spring)

399 **Seminar: Applied Educational Administration** (3 to 6) Brown
Application of the theories and principles of administration to public and private schools. Field experience in a phase of administration and supervision.

Fourth Group

A master's degree from an accredited institution is prerequisite to all fourth-group courses. All fourth-group seminars are open to doctoral candidates or other post-master's degree students with approval of instructor. Study is individually planned on the basis of previous study and experience in the subject field to attain an advanced level of competence and to meet identified professional needs or field requirements.

Each of the following courses is offered fall and spring. Each course may be repeated for credit.

401 **Seminar: Western Educational Thought** (arr.) Boswell, Darland

405 **Seminar: Human Growth and Development** (arr.) Rashid

411 **Seminar: Elementary Education** (arr.) Baker

413 **Seminar: Secondary Education** (arr.) Kulawiec

421 **Seminar: Adult Education** (arr.) Wiggs

422 **Seminar: Higher Education Administration** (arr.) Marinaccio, Greenberg, Gleazer

423 **Seminar: Higher Education** (arr.) Marinaccio, Greenberg, Gleazer, Burns, Fife

424 **Seminar: College Student Development** (arr.) Burns

425 **Seminar: Teacher Education** (arr.) **Boswell, Baker**
427 **Seminar: Human Resource Development** (arr.) Wiggs, Luke
A synthesis experience for advanced graduate students in the field of human resource development.
431 **Seminar: Administration, Curriculum, and Supervision** (arr.) Tillman, Lilly, Brown
Examination of selected major issues confronting school administrators, curriculum specialists, and supervisors.
443 **Seminar: Counseling** (arr.) **Staff**
445 **Seminar: Research and Evaluation** (arr.) Holmes, Paratore, Smith
446 **Seminar: Reading** (arr.) Peterson
490 **Pre-dissertation Seminar** (3 to 6) **Staff**
Required of all Ed.D. degree candidates. Approval of the dissertation research design is necessary for successful completion of the seminar. Admission by permission of instructor.
491 **Dissertation Research** (arr.) **Staff**
Preparation of a research outline; research and writing of an approved doctoral dissertation under the direction of major advisor and dissertation committee. **Prerequisite: Educ 490.**

Fifth Group

701 **Experimental Course** (3) **Staff**
721 **Experimental Course—Interdepartmental** (3) **Staff**

EDUCATION POLICY—DOCTORAL PROGRAM

Committee on Education Policy
A.V. Adams *(Chairman)*, J.R. Henig, A.D. Kirsch, C.J. Lange, M.N. Rashid, C.T. Stewart, Jr., R.A. Wallace

The Graduate School of Arts and Sciences offers an interdisciplinary program leading to the degree of Doctor of Philosophy in the field of education policy. The program is directed by a committee whose members are drawn from the School of Education and Human Development and from the Departments of Economics, Philosophy, Political Science, Psychology, Sociology, and Statistics.

The scope of the program is policy research and analysis as it relates to education, broadly conceived. It is intended for those who wish to pursue or continue academic careers or careers in policy-making positions.

Required: the general requirements, pages 89–91, 96–99. Students must complete three fields of study, one of which must be education policy analysis. The remaining fields will involve concentrations in two academic disciplines chosen by the student. Courses will be selected from departmental offerings.

201–2 **Seminar: Current Issues in Education Policy** (3–3) **Adams**
Review of interdisciplinary literature relating to current education policy issues with emphasis on use of research and analysis in formulating and evaluating policy.
222 **Seminar: Topics in Education Policy** (3) **Adams**
Intensive interdisciplinary study of special topics in education policy.
290 **Advanced Studies in Education Policy** (3) **Adams**
Supervised interdisciplinary study and field work in a selected policy area.
399 **Dissertation Research** (arr.) **Staff**

ENGLISH

Professors C.D. Linton, P.H. Highfill, Jr., J.G. Allee, Jr., J.P. Reesing, Jr. *(Chairman)*, R.N. Ganz, Jr.
Adjunct Professor J.C. Broderick
Associate Professors A.E. Claeyssens, Jr., R.C. Rutledge, J.A. Quitslund, J.A.A. Plotz, J.H. Maddox, C.W. Sten, G.R. Bozzini
Assistant Professors R.L. Combs, G. Carter, G. Paster, D. McAleavey, O.A. Seavey, A. Romines, M.V. Dow
Adjunct Assistant Professors F.C. Reid, S.M. Wright
Instructor J.S. Varden
Adjunct Instructors M.C. Edmondson, E. Echeverria, M. Kirkland, C. Meloni, S. Thompson, J.K. Donaldson, Jr., P.A.M. Johnson, A.J.B. Covarrubias, S.M. Spolarich, P. Connerton
Jenny McKean Moore Visiting Lecturer in Creative Writing P. Meinke

Bachelor of Arts with a major in American literature or English literature (field-of-study or departmental)—The following requirements must be fulfilled:

1. The general requirements as stated on pages 71–72, 79–85. (Students should consult the departmental advisor regarding courses to be taken in satisfying the requirements for meaningful initiation into the social sciences and the natural and mathematical sciences.)
2. Prerequisite courses—Engl 51–52 or 61–62 or 71–72 or 191–92.
3. Required courses in related areas—(a) as appropriate, 3–12 semester hours, or waiver of level 4, of a foreign language (classical Hebrew, Greek, Latin, French, German, Italian, Russian, or Spanish); (b) six semester hours of philosophy and/or religion; (c) six semester hours of history (English, American, European, or world).
4. Required for the major:

(a) *Field-of-study major*—a major examination must be passed in either American or English literature at the end of the senior year. Although no set pattern of courses is prescribed, students are expected to engage themselves with writers and works from the whole chronological span of American literature or English literature. Proseminars in American Literature, Engl 199–200, and in English Literature, Engl 195–96, assist students in their preparation for the major examination. Students who wish to be candidates for graduation with Special Honors in either American or English literature must be in the field-of-study major.

(b) *Departmental major*—30 semester hours of second-group courses offering experience with several approaches to literature which, together, make a discipline of literary study, distributed as follows:

American literature majors—Engl 120, 160, and either 161–62 or 163 and 167; three semester hours of English literature; and 15 additional hours of courses offered by the English Department, of which at least 12 hours must be in American literature.

English literature majors—Engl 120 and 194; Engl 112, 128, or 130; three semester hours of American literature; and 18 additional hours of courses offered by the English Department, of which at least 15 hours must be in English literature.

Minor in American or English literature—12 to 15 hours of second-group courses offered by the English Department, chosen in consultation with the advisor.

Master of Arts in the field of American literature—Prerequisite: the degree of Bachelor of Arts with an undergraduate major in English, or 24 semester hours in English and/or American literature above the sophomore level.

Required: the general requirements, pages 89–96, including (1) 24 semester hours of course work planned in consultation with the advisor on the basis of the student's undergraduate preparation, including a minimum of six semester hours in English literature; (2) a written Master's Comprehensive Examination; (3) a master's thesis (six semester hours) written on an approved topic under the direction of the instructor in whose field the major portion of the material falls, or, with the approval of the department advisor, 12 additional semester hours in lieu of thesis.

Master of Arts in the field of English literature—Prerequisite: the degree of Bachelor of Arts with an undergraduate major in English or American literature, or 24 semester hours in English and/or American literature above the sophomore level.

Required: the general requirements, pages 89–96, including (1) 24 semester hours of course work, planned in consultation with the advisor; (2) a written Master's Comprehensive Examination; and (3) a master's thesis (six semester hours) written on an approved topic under the direction of the instructor in whose field the material falls, or, with the approval of the department advisor, 12 additional semester hours in lieu of thesis.

Doctor of Philosophy in the field of American literature—Required: the general requirements, pages 89–91, 96–99; Level Two proficiency in an appropriate foreign language, or Level One proficiency in two appropriate foreign languages; the passing of a General Examination in the following four fields: (1) Early American literature—to 1815, (2) 1815–1900, (3) 1900 to present, (4) a fourth field, which may be either literary or interdisciplinary. Each student plans a program in consultation with a departmental committee.

Doctor of Philosophy in the field of English literature—Required: the general requirements, pages 89–91, 96–99; Level Two proficiency in an appropriate foreign language, or Level One proficiency in two appropriate foreign languages; the passing of a General Examination in four of the eight following fields: (1) beginnings to 1500, linguistics, and history of the language; (2) 1500–1660; (3) 1660–1800; (4) 1800–1900; (5) 1900 to present; (6) drama, including Shakespeare; (7) criticism; (8) American literature—one of the first three fields listed above under "Doctor of Philosophy in the field of American literature." Each student plans a program in consultation with a departmental committee.

Bachelor of Arts in Education and Human Development with a teaching field in English—Prerequisite: the education curriculum, pages 111–12.

Required: the English option and the professional courses listed on page 115.

Departmental prerequisite: Engl 9 or 10 is prerequisite to all other courses in English. A 6-semester-hour course in literature, or equivalent, or written permission of the instructor, is prerequisite for admission to all second-group courses in English except Engl 115, 117, 160–61–62, and 191–92.

Students whose College Board English Composition Achievement Test scores suggest inadequate preparation may be assigned to Engl 9 or may be tested in vocabulary, reading, spelling, grammar, standard usage, and writing skill, before placement in either Engl 9 or 10. Students whose scores or writing skill indicate superior competence will be allowed to waive Engl 10.

The admission of international students to any English course is determined by the English Placement Test for Foreign Students. Students should apply to the office of English for International Students to take this test (see pages 25–26).

ENGLISH AS A FOREIGN LANGUAGE

First Group

15 **Intensive Basic English** (0) Wright and Staff
Introduction of basic grammatical structure through oral drill and practice, and of basic practical vocabulary. Course meets fifteen class hours and five monitored laboratory hours per week. Students registered in EFL 15 will not be permitted to register for any other academic course. Tuition is charged at the rate of eight semester hours; laboratory fee, $35.

20 **Intensive Lower-Intermediate English** (0) Wright and Staff
(Formerly Intensive Basic English)
Continued basic grammar, reading, and vocabulary development; emphasis on oral skills. Course meets fifteen class hours and five monitored laboratory hours per week. Students registered in EFL 20 will not ordinarily be permitted to register for any other academic course. Tuition is charged at the rate of eight semester hours; laboratory fee, $35.

30 **Intensive Intermediate English** (0) Wright and Staff
(Formerly Intensive Lower-Intermediate English)
Introduction of complex grammatical structures, intensive reading, paragraph-level writing, and further vocabulary development and oral practice. Course meets fifteen class hours and five monitored laboratory hours per week. Students registered in EFL 30 will not ordinarily be permitted to take additional academic work unless approved by the advisor. Tuition is charged at the rate of eight semester hours; laboratory fee, $35.

40 **Intensive Higher-Intermediate English** (0) Wright and Staff
Comprehensive review of grammatical structures, enlargement of vocabulary through use of unadapted and technical reading material; development of effective reading strategies; composition focusing on outlining and techniques of exposition. Twenty hours per week. Students registered in EFL 40 will not ordinarily be permitted to take additional academic work unless approved by the advisor. Tuition is charged at the rate of eight semester hours; laboratory fee, $35.

45 **Semi-Intensive Higher-Intermediate English** (0) Wright and Staff
Practice in composition writing; selective review of problematic grammatical structures; introduction to research techniques; development of reading and speaking skills and expansion of vocabulary through use of unadapted reading materials. Ten class hours per week. Students registered in EFL 45 must register for a maximum of two other academic courses. Tuition is charged at the rate of five semester hours.

50 **English Composition/Research Methods for International Students** (3) Wright and Staff
An advanced-level composition course for international students showing a high degree of academic proficiency in English. Four class hours per week. This course can be taken by international students in lieu of Engl 9 or 10. Students registered in EFL 50 must register for a full academic load. Special fee, $25.

60 **Advanced Conversation** (0) Wright and Staff
An advanced-level conversation course for international students who show a high degree of academic proficiency in English. Development and practice of conversational skills using contemporary topics from newspaper and magazine articles, films, interviews, and guest

lectures. Five class hours per week. Tuition is charged at the rate of three semester hours; special fee, $25.

ENGLISH COMPOSITION

First Group

9 English Composition: Language as Communication (3) Claeyssens and Staff
Intensive grammar and composition course for students inadequately prepared for Engl 10. Detailed instruction, drill, and exercises in basic structure and writing paragraphs; also includes content covered in Engl 10. Class meets five hours per week. Special fee, $25. (Fall and spring)

10 English Composition: Language as Communication (3) Claeyssens and Staff
Study and practice of expository techniques; emphasis on the rhetorical complexities of unity, development, organization, and coherence, by analysis of selected current prose; library research procedure. (Fall and spring)

11 English Composition: Language and the Arts and Sciences (3) Claeyssens and Staff
Study and practice of expository and argumentative techniques; emphasis on the rhetorical complexities of the sentence and diction, and on logical thought, by analysis of selected readings on the nature of language and of the arts and sciences. Prerequisite: Engl 9 or 10. Students who receive credit for Engl 11 cannot receive credit for Engl 12 or 13. (Fall and spring)

12 English Composition: Language in Literature (3) Claeyssens and Staff
Study and practice of expository and argumentative techniques through critical writing; emphasis on the rhetorical complexities of stylistics in the sentence and diction, and on logical thought, by the study of literary genres, and of the use of language in literature. Prerequisite: Engl 9 or 10. Students who receive credit for Engl 12 cannot receive credit for Engl 11 or 13. (Fall and spring)

13 English Composition: Language and Ideas (3) Seavey, Shapiro
Study and practice of expository and argumentative techniques; emphasis on the rhetorical problems raised by different intellectual disciplines and different historical milieux. Prerequisite: Engl 9 or 10. To be taken only in conjunction with Clas/Engl/Hist/Phil/Rel 41. Students who receive credit for Engl 13 cannot receive credit for Engl 11 or 12. (Spring)

Second Group

100 Expository Writing in Accounting (3) Claeyssens and Staff
Special emphasis on writing related to accounting and auditing, with weekly exercises on designated topics; selected readings. Prerequisite: Engl 9 or 10; 11; junior status. (Fall and spring)

101 Advanced Expository Writing (3) Claeyssens and Staff
(Formerly Expository Writing)
Types of expository writing; weekly assignments based on students' needs; particular attention may be given to problems in the writing of graduate theses. Prerequisite: Engl 9 or 10; 11 or 12. (Fall and spring) Staff

110 Expository Writing for the Professions (3)
Weekly exercises based on students' individual needs; particular at-

tention given to problems in writing for technically sophisticated readers. Selected readings. (Fall and spring)

Third Group

201–2 **The Teaching of Composition** (3–3) Claeyssens
(Academic year)

CREATIVE WRITING

102 **Introduction to Creative Writing** (3) Staff
Discussion of student poetry and/or prose fiction. Prerequisite: Engl 9 or 10; 11 or 12; consent of instructor. (Fall and spring)

103 **The Writing of Fiction—the Short Story** (3) McAleavey
Prerequisite: Engl 102; consent of instructor. The student should submit a writing sample to the instructor before registration. (Fall)

104 **The Writing of Poetry** (3) Staff
Prerequisite: Engl 102; consent of instructor. The student should submit a writing sample to the instructor before registration.

105–6 **The Writing of Plays** (3–3) Claeyssens
Same as SpDr 105–6. Prerequisite: Engl 9 or 10; 11 or 12; consent of instructor. The student should submit a writing sample to the instructor before registration. (Academic Year)

107 **The Writing of Fiction—the Novel** (3) Claeyssens
Prerequisite: Engl 102 or 103; consent of instructor. The student should submit a writing sample to the instructor before registration. (Spring)

108 **Advanced Creative Writing** (3) McAleavey
Prerequisite: Engl 102; consent of instructor. The student should submit a writing sample to the instructor before registration.

ENGLISH LITERATURE

First Group

41 **Roots of the Western Tradition** (3) Staff
Same as Clas/Hist/Phil/Rel 41. Basic ideas of western thought from early Greek, Roman, Judaic, and Christian traditions. Representative readings in drama, epic, historical writings, oratory, creation stories, scriptural traditions, philosophy, and spiritual autobiography. To be taken in conjunction with Engl 13. (Spring)

51–52 **Introduction to English Literature** (3–3) Rutledge and Staff
Representative works by major authors studied in their historical context; discussion of recurrent themes, and introduction to various types and forms of imaginative literature. (Academic year)

61 **Tragedy** (3) Carter
Modes of tragedy as developed in drama, nondramatic verse, and prose fiction in literature from ancient to modern times—Book of Job to Beckett. (Fall)

62 **Comedy** (3) Paster
Modes of comedy as developed in drama, nondramatic verse, and prose fiction—Chaucer to Borges. (Spring)

Second Group

111 **Medieval English Literature—Exclusive of Chaucer** (3) Allee

112 **Chaucer** (3) Allee
(Spring)

115 **History of the English Language** (3) Allee
Development of the English language in a historical treatment of English grammar.

116 **Medieval Legend and Saga** (3) Allee
Celtic and Norse.

117 **Advanced English Syntax** (3) Allee
Study of English grammar through various approaches. Emphasis on syntax, including analysis of special syntactical problems. (Fall)

120 **Practical Criticism** (3) Plotz
Uses of language and complex shapes of thought in literature; introduction to mature study and full enjoyment of poetry, fiction, and drama. (Fall and spring)

123 **Principles of Literary Criticism** (3) Carter
Works of major critics; consideration of ways in which literature is analyzed, classified, judged, and justified; Aristotle, Longinus, Dryden, Johnson, Coleridge, Schiller, Arnold, Eliot, Richards, Frye. (Fall)

125–26 **Elizabethan Verse and Prose** (3–3) Quitslund

127–28 **Shakespeare** (3–3) Highfill
Development of dramatic forms and recurrent themes. Engl 127: histories and comedies. Engl 128: tragedies. (Academic year)

129 **The Earlier 17th Century** (3) Reesing
Poetry and prose to 1660, exclusive of Milton.

130 **Milton** (3) Reesing
(Fall)

131–32 **English Literature, 1660-1780** (3–3) Highfill
Poetry and prose of the Neoclassic period. Engl 131: 1660–1740. Engl 132: 1740–1780. (Academic year)

133–34 **The Romantic Movement** (3–3) Plotz
Engl 133: Blake, Wordsworth, Coleridge. Engl 134: Byron, Shelley, Keats. (Engl 134—spring)

135–36 **Victorian Literature** (3–3) Carter
Engl 135: Tennyson, Browning, Arnold; Dickens; Carlyle, Ruskin. Engl 136: George Eliot, Browning, Tennyson, Swinburne, Hardy, Hopkins, Wilde, Pater.

137–38 **The 20th Century** (3–3) Linton
Literature since 1900. Engl 137: poetry and criticism. Engl 138: drama and the novel. (Engl 137—spring)

145–46 **Special Topics in English Literature** (3–3) Linton, Rutledge
Each course may be repeated for credit. (Academic year)

147–48 **Special Topics in English Literature** (3–3) Maddox, Paster
Each course may be repeated for credit. (Academic year)

149 **The Romantic Movement** (3) Combs
Poetry and prose, 1780-1830. Students who receive credit for Engl 149 cannot receive credit for Engl 133 or 134.

153–54 **The English Novel** (3–3) Maddox
Major novelists. Engl 153: 18th century. Engl 154: 19th century. (Academic year)

155–56 **The English Drama** (3–3) Paster, Highfill
Engl 155: Shakespeare's contemporaries. Engl 156: Historical survey, 1660 to present.

157 **20th-Century Drama** (3) Paster
Representative continental, English, and American plays of the 20th century.

158 **20th-Century British Prose Fiction** (3)

191–92 **Introduction to European Literature** (3–3) Seavey
Selected major works in various genres, read in translation and in entirety. Engl 191: *Iliad* and *Aeneid*; dramas from ancient to modern times. Engl 192: Plato, Ovid, and Dante; medieval saga and romance; prose fiction from Cervantes to Mann. Open to freshmen and sophomores. May be taken to satisfy the requirement for meaningful initiation into the humanities. (Academic year)

194 **History of English Literature** (3) Reesing
(Spring)

195–96 **Proseminar in English Literature** (3–3) Quitslund
For field-of-study majors in English literature. Themes and concerns basic to the English literary tradition, which draw connections between diverse works from the Old English period to recent times. (Academic year)

197 **Independent Study** (3) Reesing and Staff
Open to honors candidates in the field-of-study major in English literature during their senior year. (Fall and spring)

198 **Senior Honors Thesis** (3) Ganz and Staff
Independent study. Under the guidance of an instructor, the student writes a thesis on an approved topic. Open to qualified seniors in the field-of-study major in English literature. (Fall and spring)

Third Group

212 **Studies in Chaucer** (3) Allee

213 **Old English** (3) Allee
Old English grammar and readings. (Fall)

214 **Beowulf** (3) Allee
Prerequisite: Engl 213 or equivalent. (Spring)

219 **Research Methods and Bibliographical Materials** (3) Broderick
Principal bibliographical sources and typical problems in research. (Fall)

223–24 **Studies in Literary Criticism** (3–3) Plotz

225–26 **Studies in 16th-Century English Literature** (3–3) Quitslund

227–28 **Studies in Shakespeare and his Contemporaries** (3–3) Paster
(Academic year)

230 **Studies in Milton** (3) Reesing

231–32 **Studies in English Literature, 1660–1780** (3–3) Highfill

233–34 **Studies in the Romantic Movement** (3–3) Plotz
(Engl 233—fall)

235–36 **Studies in Victorian Literature** (3–3) Carter
(Engl 236—spring)

237–38 **Studies in 20th-Century Literature** (3–3) Linton

253–54 **Seminar: The English Novel** (3–3) Maddox

299–300 **Thesis Research** (3–3) Staff
(Fall and spring)

Fourth Group

George Washington University is a member of the Folger Institute of Renaissance and 18th-century Studies. Institute policies are set by a central committee on which each member institution is represented. Doctoral students enrolled in one of the Institute seminars are eligible to apply for fellowship aid. Folger Institute Seminars are numbered 301 through 308. Students wishing to register for these courses should consult the chairman of the English Department.

301–8 **Folger Institute Seminars** (3 credits each) Staff
Topics will be announced in the *Schedule of Classes*. May be repeated for credit provided the topic differs.

398 **Advanced Reading and Research** (arr.) Staff
Limited to students preparing for the Doctor of Philosophy general examination. May be repeated for credit. (Fall and spring)

399 **Dissertation Research** (arr.) Staff
Limited to Doctor of Philosophy candidates. May be repeated for credit. (Fall and spring)

AMERICAN LITERATURE

First Group

71–72 **Introduction to American Literature** (3–3) Ganz and Staff
Historical survey. Engl 71: From beginnings to the Civil War. Engl 72: From the Civil War to present. (Academic year)

Second Group

120 **Practical Criticism** (3) Plotz
Uses of language and complex shapes of thought in literature; introduction to mature study and full enjoyment of poetry, fiction, and drama. (Fall and spring)

160-61-62 **Studies in American Literature** (3–3–3) Seavey, Sten, Romines
Same as AmCv 160–61–62. The shaping of America's literary and cultural traditions as shown by major writers. Engl 160: The Colonial and Early National Periods: Bradstreet, Cotton Mather, Edwards, Franklin, Crevecoeur, and others. Engl 161: The Romantic Period: Poe, Emerson, Hawthorne, Melville, Thoreau, Whitman, Dickinson, and others. Engl 162: The Realist Period: Twain, James, Crane, Howells, Wharton, Chopin, Robinson, and others. (Engl 160, 162—fall. 161—spring)

163–64 **American Poetry** (3–3) Ganz
(Formerly Major American Poets)
Close examination of major American poems. Engl 163: From the beginnings through the early 20th century: works by Bradstreet, Taylor, Poe, Emerson, Whitman, Dickinson, Robinson, Frost, and others. Engl 164: The 20th-century modernist poets: Stevens, Pound, Williams, Eliot, Ransom, Cummings, Crane, and others. (Academic year)

165–66 **American Drama** (3–3) Combs, Claeyssens
Historical and critical study of significant plays and forms. Engl 165: The life and works of Eugene O'Neill, and the dramatic techniques of Ibsen, Chekhov, and Strindberg which helped to shape 20th-century American drama; biographical and critical readings included. Engl 166: Significant and representative works of American theater, 1935–1975, including plays by Clifford Odets, Lillian Hellman, William Saroyan, Thornton Wilder, Arthur Miller, William Inge, Tennessee Williams, Eugene O'Neill, Carson McCullers, Lorraine Hansberry, and outstanding examples of musical comedy. (Academic year)

167–68 **The American Novel** (3–3) Sten, Maddox
Historical and critical study of major works in the American novelistic tradition. Engl 167: From beginnings through the 19th century: Hawthorne, Melville, James, Twain, Dreiser, Chopin, and others. Engl 168: The 20th century: Wharton, Anderson, Hemingway, Fitzgerald, Lewis, Faulkner, and others. (Academic year)

170 **The American Short Story** (3) Combs
An extensive survey of short fiction by a wide variety of writers of the 19th and 20th centuries, about half of them American; readings

on the art of the short story by writers and literary critics included. (Spring)

171–72 **Major American Writers** (3–3) Romines
Each course may be repeated for credit. (Engl 172—fall)

173–74 **Selected Literary Movements** (3–3) Combs
Each course may be repeated for credit. (Engl 173—fall)

175–76 **Special Topics in American Literature** (3–3) Plotz
Each course may be repeated for credit. (Engl 175—spring)

177–78 **Contemporary American Literature** (3–3) Ganz, Claeyssens
Major and representative works, 1946–1980. Engl 177: poetry, fiction, and non-fiction by Flannery O'Connor, Ginsberg, Kerouac, Rich, Lowell, Plath, Mailer, Roethke, Baraka, Berryman, Ashbery, and others. Engl 178: essay, short story, and novel: Robert Penn Warren, J.D. Salinger, James Agee, E.B. White, Cheever, Nabokov, Welty, Wilder, Tillie Olson, Bellow, John McPhee. (Academic year)

181–82 **TBA** (3–3) TBA
Two special courses offered each year by the Jenny McKean Moore Visiting Lecturer in Creative Writing. Each course may be repeated for credit. (Academic year)

197 **Independent Study** (3) Reesing and Staff
Open to honors candidates in the field-of-study major in American literature during their senior year. (Fall and spring)

198 **Senior Honors Thesis** (3) Ganz and Staff
Independent study. Under the guidance of an instructor, the student writes a thesis on an approved topic. Open to qualified seniors in the field-of-study major in American literature. (Fall and spring)

199–200 **Proseminar in American Literature** (3–3) Sten
For field-of-study majors in American literature. Readings, conferences, and group discussions. (Academic year)

Third Group

219 **Research Methods and Bibliographical Materials** (3) Broderick
Principal bibliographical sources and typical problems in research. (Fall)

263–64 **Seminar: American Poetry** (3–3) Ganz
American poets and critics of poetry.
(Engl 264—fall)

267–68 **Seminar: American Fiction** (3–3) Maddox
Research and critical reading: fiction and the criticism of fiction. (Engl 267—fall)

281–82 **Seminar: Early American Literature** (3–3) Seavey
(Engl 281—spring)

283–84 **Seminar: American Romanticism** (3–3) Broderick
Engl 283: Melville—the early fiction. Engl 284: Emerson, Thoreau, and the Concord Group: the intellectual background and the literary achievement. (Engl 284—spring)

285–86 **Seminar: American Realism, 1865-1915** (3–3) Romines, Sten
(Formerly *Seminar: American Literature, 1865–1900*)
Realistic prose fiction in various contexts—literary, intellectual, cultural. (Engl 286—spring)

299–300 **Thesis Research** (3–3) Staff
(Fall and spring)

Fourth Group Staff

398 **Advanced Reading and Research** (arr.)
Limited to students preparing for the Doctor of Philosophy general examination. May be repeated for credit. (Fall and spring)

Staff
399 **Dissertation Research** (arr.)
Limited to Doctor of Philosophy candidates. May be repeated for credit. (Fall and spring)

HUMANITIES*

43–44 **Classical Humanities** (3–3)
Lectures in the origins and development of Western civilization from approximately 3000 B.C. to 1300 A.D. Engl 43 considers the civilization of the Old Testament period and of Classical Greece through readings in the Old Testament and in Homer, Aeschylus, Sophocles, Euripides, Aristophanes, Herodotus, Thucydides, Plato, and Aristotle. Engl 44 considers the civilization of the Roman Empire and of medieval Europe through readings in Virgil, Tacitus, St. Augustine, Aquinas, and Dante, and in medieval romance. Objective quizzes and one paper.

45–46 **Humanities in the Modern World** (3–3)
Lectures in the development of Western civilization from the 14th to the 20th centuries. Engl 45 considers Renaissance and Neoclassical culture through readings in Machiavelli, Cellini, Shakespeare, Cervantes, Bacon, Moliere, and Voltaire. Engl 46 considers aspects of Romanticism and Modernism manifested in works by Goethe, Flaubert, Zola, Nietzsche, Mann, Chekhov, and Joyce. Objective quizzes and one paper.

ENVIRONMENTAL STUDIES

Committee on Environmental Studies
A.K. Fitzsimmons *(Chairman)*, R.S. French, R.W. Kenny, R.C. Lindholm, H. Merchant, W.C. Parke, W.E. Schmidt, A.M. Yezer

Columbian College of Arts and Sciences offers interdepartmental programs in environmental studies leading to the degree of Bachelor of Arts or Bachelor of Science. The program leading to the degree of Bachelor of Arts is designed for the student who is oriented toward participating in environmental decision-making with emphasis on the perspective of the social sciences. The program leading to the degree of Bachelor of Science is designed for the student with well-developed interests in science who seeks professional identification as a field or laboratory worker in the environmental sciences.

Bachelor of Arts with a major in environmental studies (departmental)—The following requirements must be fulfilled:

1. The general requirements as stated on pages 71–72, 79–85.

2. Prerequisite courses (qualified students may substitute advanced courses with departmental permission, in order to include more elective courses in their program):

(a) Statistics—Stat 91.

(b) Natural sciences—six to eight semester hours selected from BiSc 3–4, 11–12; Chem 11–12; Geol 1–2, 21–22; or Phys 1, 2. Courses designated for non-science majors must be passed with a grade of *A* or *B* to be accepted toward fulfilling the introductory natural science requirement. This includes BiSc 3–4 and Geol 1–2.

* Courses are offered off campus only.

(c) Social sciences—Econ 1–2, plus 6 semester hours selected from Anth 1–2; Geog 1, 2, 3; PSc 1, 2; Psyc 1, 5–6; or Soc 1, 2.

3. Required courses in the major (51 semester hours):

(a) BiSc 140; Econ 136; Geog 132.

(b) Eight semester hours selected from BiSc 101, 102, 103, 108, 109, 110, 111, 115, 118, 123, 124, 125, 127, 135, 141, 143, 144, 145, 146, 149, 150, 161, 167, 185, 208, 210, 211, 237, 242; Chem 22, 50, 122, 151–52, 153–54; Geol 5, 105, 125, 128, 141, 163, 181, 272; Phys 6, 14, 15, 16, 27–28.

(c) 24 semester hours in courses selected from two departments in the following—Anth 151, 152, 171, 186, 187, 188, 263, 267; Econ 101, 102, 157, 158, 161, 199, 237; Geog 106, 107, 108, 110, 127, 134, 135, 136, 137, 140, 142, 143, 145, 221, 222; PSc 111, 112, 117, 118, 120, 122, 187; Psyc 104, 144, 151, 156; Soc 126, 127, 128, 151, 152, 181.

(d) Envr 151–52, 157.

Bachelor of Science with a major in environmental studies (departmental)—**The following requirements must be fulfilled:**

1. The general requirements as stated on pages 71–72, 79–85.

2. Prerequisite courses (qualified students may substitute advanced courses with departmental permission, in order to include more elective courses in their program):

(a) Statistics—Stat 91.

(b) Natural sciences—12 to 16 semester hours selected from BiSc 11–12; Chem 11–12; Geol 21–22; Phys 1, 2. Either BiSc 11–12 or Chem 11–12 must be selected.

(c) Social sciences—Econ 1–2, plus 6 semester hours selected from Anth 1–2; Geog 1, 2, 3; PSc 1, 2; Psyc 1, 5–6; Soc 1, 2.

3. Required courses for the major (51 semester hours):

(a) BiSc 140; Econ 136; Geog 132.

(b) 23 semester hours selected from BiSc 101, 102, 103, 108, 109, 110, 111, 115, 118, 123, 124, 125, 127, 135, 141, 143, 144, 145, 146, 149, 150, 161, 167, 185, 208, 210, 211, 237, 242; Chem 22, 50, 122, 151–52, 153–54; Geol 5, 105, 125, 128, 141, 163, 181, 272; Phys 6, 14, 15, 16, 27–28.

(c) 9 semester hours selected from Anth 151, 152, 171, 186, 187, 188, 263, 267; Econ 101, 102, 157, 158, 161, 199, 237; Geog 106, 107, 108, 110, 127, 134, 135, 136, 137, 140, 142, 143, 145, 221, 222; PSc 104, 111, 112, 117, 118, 120, 122, 187; Psyc 104, 144, 151, 156; Soc 126, 127, 128, 151, 152, 181.

(d) Envr 151–52, 157.

The science and social science courses listed under 3(b) and 3(c) above must be taken in not more than *three* departments. Not more than six hours of service-learning courses may count toward fulfilling requirements of the major.

In choosing elective courses for both the Bachelor of Arts and Bachelor of Science degree programs, students are reminded that permission of the Dean of Columbian College of Arts and Sciences and the Committee on Environmental Studies is necessary to take courses not offered by Columbian College of Arts and Sciences, and that a maximum of 12 semester hours of such courses may be taken. The following may be of interest to the environmental studies major: BAd 101, 171, 201, 203; *CE 194, 197; HKLS 152; U&RP 153, 201, 205. The permission of the instructor, the department chairman, and the Dean of the School of Government and Business Administration is necessary to take graduate courses (numbered 201 and above) in that School.

151–52 Senior Seminar in Environmental Studies (3–3) **Staff**
Limited to majors in environmental studies. Directed reading and discussion of contemporary environmental problems.

*See the School of Engineering and Applied Science Bulletin for civil engineering courses.

157 **Introduction to Environmental Law** (3)
An introduction to selected pieces of major environmental legislation. The role of the courts and bureaucracy in implementing and interpreting legislation. Impact on decision-making. Designed for students with no training in law.

158 **Special Topics in Environmental Law** (3)
Analysis of environmental laws which focus on a particular environmental issue. Topics will vary. Prerequisite: Envr 157 or permission of instructor.

159–60 **Field Experience** (3–3)
Open to juniors and seniors majoring in environmental studies. Students will spend at least eight hours per week in a political, technical, legal, or special interest organization working on environmental questions.

EXPERIMENTAL HUMANITIES*

Professors W.E. Schmidt, R.S. French
Associate Professor W.C. Parke
Adjunct Associate Professor L.J. Lear *(Coordinator)*
Assistant Professors D.J. Lynn, S.R. Lichter
Instructor L.P. Love

First Group

2–3 **Politics and Values** (3–3) — Lichter
A freshman course; limited enrollment. Students will be housed in Thurston Hall. Field-study and case-study of value conflicts implicit in selected political issues involving federal policy and legislation. Concurrent registration in special sections of PSc 2 and 3 required. Students registering for Hum 2 in the fall semester will be expected to register for Hum 3 in the spring semester. Admission by permission of instructor. (Fall and spring)

26 **Environmental Issues** (3) — French
An interdisciplinary analysis of selected aspects of the population question, pollution and human health, urban environmental problems, issues of economic growth and development, technology and public policy. (Spring)

40 **Washington, D.C.: Culture and Politics** (3) — Lear and Interdisciplinary Team
An all-university course designed to introduce students to the interdisciplinary methods of studying the contemporary city. Major problems of metropolitan life, past and present, analyzed by faculty and community leaders. Emphasis on experiential team projects. (Fall)

Second Group

101 **Supervised Field Study** (6) — French
Community-based projects supervised by appropriate faculty. Juniors and seniors admitted by permission of instructor. (Fall and spring)

171 **The Legal Process** (3) — Love
The function which law plays in society and the nature of the legal process. Examination of the societal assumptions and values that mold the law. Emphasis upon institutions that make up the law—the

* Administered by the Division of Experimental Programs.

courts, administrative agencies, legislative bodies, and executive agencies. Open only to juniors and seniors by permission of instructor. (Academic year)

174 Science and Values (1 or 3) Schmidt, Parke
Study of the effects of scientific knowledge and technology on social institutions and the image of man, of the question of ethics and morality in science, and of the science of values. Admission by permission of instructor.

198 Conference on Policy Studies and the Humanities (3) Lynn
Examination of a selected policy issue (e.g., health care, freedom of information, drug abuse) in relation to alternative social goals. Open to graduate, law, and medical students, as well as advanced undergraduates by permission of instructors.

FORENSIC SCIENCES—GRADUATE PROGRAMS

Professors T.P. Perros, J.E. Starrs, T.F. Courtless, Jr., C. O'Rear *(Chairman)*
Adjunct Professor C.G. McWright
Professorial Lecturers B.J. White, C.B. Cunningham, L.R. Goldbaum, R.L. Thompson, E.G. Howe, T.F. Kelleher
Associate Professors N.T. Lappas, W.F. Rowe
Associate Professorial Lecturers J.T. Smith, G.M. Saiger, C.E. Bohn, J.L. Melnick, K.E. Melson, H.F. Schuelke III, L.H. Wechsler, D.S. Dixon, R.H. Parker, J.P. Hume, B.W. Given, S.H. Manne, J.D. Spencer
Assistant Professorial Lecturers N.R. Janis, M. Stajic, J.L. Lyons, D. Beard, J. Blumenfeld, J. Harris, M.M. Levy, S.R. Lorigo, W.A. Bayse, C.E. Bruce, R.E. Easton, T.M. Fortuin, J.T. Kotelly, J.L. Mudd

Master of Forensic Sciences—Prerequisite: a bachelor's or a graduate degree from an accredited institution of higher learning and academic or professional experience in the behavioral, biological, or physical sciences, or law, medicine, or law enforcement.

Required: the general requirements, pages 89–96. For students not electing a thesis, 36 semester hours of course work are required; for students electing a thesis, 30 semester hours of course work, plus a thesis (equivalent to six semester hours), are required. ForS 220, 221, 224, and 225 are required of all students. ForS 224 may be waived for students having an LL.B. or J.D. degree from an accredited law school. The following are also required: (1) nine hours selected from ForS 201, 202, 203, 204, and 205; (2) nine hours selected from ForS 214, 260, 261, 265, and 269; (3) the remaining semester hours must be selected in consultation with the advisor from the behavioral sciences, law, management science, or forensic sciences. It is strongly recommended that students participate in the internship program. All candidates are required to pass a written Master's Comprehensive Examination. There is no tool requirement.

Master of Science in the field of chemical toxicology—Prerequisite: completion of the first three years of the combined B.S./M.S. program in chemical toxicology (see Chemistry Department) or its equivalent. Courses may be required to remove academic deficiencies.

Required: the general requirements, pages 89–96. The following courses are required: Bioc 221–22; Phyl 191; Phar 203; ForS 240, 242, 245; two courses selected from ForS 246, 248, 249, 269; ForS 299–300 or Chem 299–300. Chem 121, 141, 142 and Stat 127 will be required of students who have not had these courses or their equivalent. All candidates are required to pass a Master's Comprehensive Examination. There is no tool requirement.

Master of Science in Forensic Science—Prerequisite: a bachelor's or graduate degree in the biological or physical sciences from an accredited college or university.

Required: the general requirements, pages 89–96. The program of study consists of 30 semester hours of course work, plus a thesis (equivalent to six semester hours). Individualized programs of study will be developed to meet the career objectives of each student. Students may specialize in forensic chemistry, toxicology, or serology. Each such program of study must include ForS 224 and 225. All candidates must also participate in the departmental seminar each semester. The remaining semester hours must be selected from approved courses in the forensic sciences, biological and physical sciences, management science, law, or basic medical sciences. It is strongly recommended that students participate in the internship program. All candidates are required to pass a written Master's Comprehensive Examination. Candidates must also fulfill the tool requirement by passing a reading knowledge examination in French, German, or Russian, or by satisfactorily completing the tool requirement in either statistics or computer programming.

Master of Arts in Special Studies—Prerequisite: a bachelor's or graduate degree from an accredited college or university.

a) *With a concentration in Criminal Justice*—

Required: the general requirements, pages 89–96. The program of study consists of 36 semester hours of approved course work drawing from the forensic sciences, law, criminology, management science, sociology, and psychology. ForS 214, 220, 221, 224, 225, 228, 265, 266, 274, 290; Soc 259, 261 are recommended. All candidates are required to pass a written Master's Comprehensive Examination. There is no tool requirement.

b) *With a concentration in Crime in Commerce*—

Required: the general requirements, pages 89–96. The program of study consists of 36 semester hours of approved course work drawing upon the forensic sciences, law, accounting, computer science, investigative techniques, and management. ForS 203, 224, 225, 229, 232, 233, 234, 235, 251, 267, 274, and Stat 197 are recommended. All candidates are required to pass a written Master's Comprehensive Examination. There is no tool requirement.

The interdisciplinary programs leading to the degrees of Master of Arts in Special Studies, Master of Forensic Sciences, and Master of Science in Forensic Science may include course work from the School of Government and Business Administration, from the National Law Center, from the School of Medicine and Health Sciences, and graduate course work in the behavioral, biological, and physical science departments of the University. Students work closely with their advisors in setting up a program that meets their interests, needs, and background knowledge. The Department of Forensic Sciences is affiliated with the Armed Forces Institute of Pathology in a program of mutual exchange among students, courses, and facilities. For further information, contact the Department of Forensic Sciences.

Lappas

201 Forensic Serology I (3)
Principles of the forensic analysis of blood and other biological materials. Specific procedures and techniques used in forensic serology. Laboratory exercises.

Perros, Rowe

202 Instrumental Analysis (3)
Principles and application of various instrumental methods to the examination of criminal evidence, including chromatographic and spectrophometric techniques and mass spectrometry. Laboratory exercises.

203 **Examination of Questioned Documents** (3) Bohn
Theory and principles of handwriting and handprinting, duplicating processes, paper manufacture and fiber analysis; studies of paper and methods of examining questioned documents. Laboratory exercises.

204 **Firearms and Tool-mark Identification** (3) Cunningham, Rowe
Methods for identifying firearms, cartridge casings, tool-marks, tire marks, and footprints. Laboratory exercises.

205 **Personal Identification** (3) Given
Methods of personal identification based on sketches, fingerprints, voiceprints, odontology, and study of skeletal remains.

214 **Forensic Psychiatry** (3) Howe, Saiger, Smith, Manne
Introduction to the constructs of dynamic psychiatry, psychiatric treatment, and the nomenclature of mental disorders. Consideration of expert testimony, direct examination, and cross-examination in hospitalization and criminal cases.

220 **Physical Aspects of Forensic Sciences** (3) O'Rear, Rowe
Survey of forensic physical sciences; fingerprints, firearm and tool-mark examinations, document examinations, and examinations of trace evidence such as glass, soil, paint, hairs, and fibers; crime scene investigations; qualifications and preparation of expert witnesses; operation and functioning of the forensic science laboratory.

221 **Biological Aspects of Forensic Sciences** (3) Lappas, Rowe
Principles of forensic pathology, serology, and toxicology. The role of the forensic laboratory in the identification of human remains; determination of the time, cause, and manner of death; partial individualization of biological materials; and the detection of drugs in biological materials.

224 **Criminal Law I** (3) Starrs, Hume, Beard, Schulman
Principles of criminal law and procedure, preparation and presentation of evidence, examination of witnesses, and methods of legal research.

225 **Criminal Law II: Evidence** (3) Melson, Melnick, Janis
Procedural rules affecting the collection and use of physical evidence. Emphasis on court opinions defining the rules of search and seizure and admissibility of evidence. Prerequisite: ForS 224.

227 **Criminal Law III: Procedure** (3) Schuelke, Wechsler
Decision to arrest, prosecutive discretion, bail, the preliminary hearing, right to a speedy trial, discovery, plea bargaining, publicity, post-conviction procedures. Prerequisite: ForS 224.

228 **Administration of Criminal Justice** (3) Schulman, Richman
Consideration and analysis of selected advanced problems in the administration of criminal justice. Emphasis on the role and professional responsibilities of prosecutor and defense counsel and on developmental trends in the law. Prerequisite: ForS 224.

229 **Criminal Law IV: Contracts** (3) Harris
Concepts and principles of law encountered in commercial activities: contracts, sales, negotiable instruments, and bankruptcy. Emphasis on recognition of deceptive contracting practices. Statutes and government regulation governing contracts.

232 **Crime in Commerce I: Accounting** (3) Levy, Lorigo
Principles of accounting; abuse and misuse of accounting procedures; use of accounting in the investigation of commercial crime.

233 **Crime in Commerce II: Procurement and Supply** (3) Levy, Lorigo
Governmental and private sector procurement procedures; techniques

of inventory management; abuse of procurement procedures and illicit diversion of supplies.

234 **Crime in Commerce III: Information Systems** (3) Staff
Principles of management information systems; security of information system and facilities; compromising of information systems.

235 **Crime in Commerce IV: Conspiracy** (3) Leibowitz
Legal definition of conspiracy; quantum of proof; use of investigative techniques to establish the existence of criminal conspiracies.

240 **Principles of Toxicology** (4) Lappas
Concepts of toxicology including its historical development and modern applications, drug disposition, mechanisms of toxicity; factors which influence toxicity and toxicity evaluation.

242 **Chemistry of Organic Medicinal Agents** (3) O'Rear
A correlated study of the compostion, constitution, physical and chemical properties and pharmaceutical uses of organic medicinal agents. Included are discussions of the heterocyclic chemistry of these agents.

245 **Analytical Toxicology** (4) Lappas
A study of qualitative and quantitative principles and procedures used in the detection, identification, isolation, purification and potency determination of drugs. Laboratory.

246 **Environmental Toxicology** (3) Staff
A study of the chemical substances to which humans are unintentionally exposed. Emphasis will be placed on pesticides, food additives and air pollutants.

248 **Clinical Toxicology** (3) Staff
A study of the adverse effects caused by or related to the use of drugs. The signs and symptoms, diagnoses and treatments will be emphasized.

249 **Industrial Toxicology** (3) Staff
A study of the potential hazards encountered by workers as a result of their exposure to raw materials, intermediates and finished products. The types of exposure and methods of predicting and preventing toxic exposure will be emphasized.

250 **Interdisciplinary Aspects of Forensic Science** (3) Starrs, Blumenfeld
Scientific and legal aspects of current concepts. Includes qualification as an expert witness, chain of custody, impact of testimony on the jury, admissibility of evidence, class evidence vs. individualized evidence, and search and seizure. Prerequisite: ForS 224.

251 **Moot Court** (3) Janis, Wechsler
Students will prepare and present direct testimony and be cross-examined by an experienced trial attorney in simulated courtroom setting. Class discussions of problems, techniques. Lectures on discovery, admissibility of scientific evidence, chain of custody, use of notes, etc. Prerequisite: ForS 224.

254 **Selected Topics in the Forensic Sciences** (3) Staff
Current issues in research, investigation, and law.

260 **Principles of Forensic Medicine** (3) Thompson, Mueller
Anatomy and physiology of the human body with emphasis on understanding the processes underlying traumatic and unexpected deaths encountered in forensic pathology. Bone growth and repair as it relates to child abuse, structure and functions of the heart relating to sudden death, and anatomic area of the brain prone to hemorrhagic lesions following trauma.

261 **Principles of Forensic Pathology** (3) Thompson, Wagner
Terminology and scientific techniques used in medico-legal investigations, sudden or unexpected deaths, homicides, suicides, accidental deaths, and trauma.

265 **Drugs of Abuse** (3) Lappas, O'Rear, Stajic
Chemical, pharmacological, toxicological, and pathological characteristics of commonly abused drugs, including ethanol, barbiturates, narcotics, stimulants, and hallucinogens. Primarily for M.A. in Sp.Std. degree candidates; open to others with permission of instructor.

266 **Seminar: Modern Trends in Criminal Justice** (3) O'Rear, Yeager
Recent advances in criminal justice. Discussions incorporate several disciplines including science, law, management, social sciences, and psychology.

267 **Seminar: Crime in Commerce** (3) Staff
Interdisciplinary course in current problems in the investigation and prosecution of commercial offenses.

268 **Photography in the Forensic Sciences** (3) Thompson
Basic use of forensic photography, including selection and use of equipment, photographs as evidence, close-up work, and common misconceptions. Laboratory fee, $25.

269 **Forensic Toxicology I** (3) Lappas
Relevant underlying biological, chemical, and pharmacological principles of forensic toxicology.

270 **Medicinal Chemistry** (3) O'Rear
Theory and principles of classification, synthesis, and structure activity relationships of drugs. Discussion of the complex chemical events that take place between administration of a drug and its action on the user, with emphasis on drugs of abuse.

271 **Forensic Serology II** (3) Lappas
Methods in forensic serology. Laboratory examinations and classifications of dried blood and other biological materials. Independent laboratory projects. Laboratory fee, $25. Prerequisite: ForS 201, or permission of instructor.

272 **Forensic Toxicology II** (3) Lappas
Lectures, student seminars, laboratory exercises, and projects dealing with topics of current interest in forensic toxicology. Prerequisite: ForS 269 or permission of instructor. Laboratory fee, $25.

273 **Forensic Chemistry I** (3) Rowe
Examination of glass, soils, hairs, and fibers. Laboratory exercises include refractive index measurements using immersion methods; polarized light observations of minerals, hairs, and fibers; elemental analysis of glass and soil by spectroscopic methods; x-ray diffraction analysis of minerals; and classical chemical and physical methods of analysis. Prerequisite: ForS 202 or permission of instructor. Laboratory fee, $25.

274 **Management of Criminal Justice Organizations** (3) O'Rear, Parker
Theories of management with emphasis on leadership. Interaction of individuals, groups, managers, and the organization as a whole. Discussions centered on the criminal justice system.

280 **Forensic Chemistry II** (3) Rowe
Examination of arson accelerants, textile fibers, plastics, and paints. Laboratory exercises include infrared spectrophotometry and pyrolysis—gas-liquid chromatography of polymeric materials, as well as classical chemical and physical methods of analysis. Prerequisite: ForS 273. Laboratory fee, $25.

290 **Research in Criminal Justice** (3) Courtless
An examination of the role and process of research as it serves the criminal justice systems. Presentations and discussions of the literature with emphasis on the use of research and analysis in formulating and evaluating criminal justice policy.

Research (arr.) Staff
Open to qualified master's degree students. Research on problems approved by the department chairman or academic advisor, under the supervision of an appropriate staff member.

299–300 **Thesis Research** (3–3) Staff
(Fall and spring)

FRENCH

See **Romance Languages and Literatures.**

GENERAL CURRICULUM IN THE LIBERAL ARTS

Bachelor of Arts: General Curriculum in the Liberal Arts (departmental)—**The following requirements must be fulfilled:**

1. The general requirements as stated on pages 71–72, 79–85.
2. *Humanities*—39 semester hours:

(a) 6 semester hours selected from Engl 9 or 10, 11 or 12, 101.

(b) 18 semester hours (of which 6 semester hours must be in a foreign language) selected from Chin 103–04; Clas 71, 72, 108, 113; Engl 51–52, 61–62, 71–72, 127–28, 153–54, 155–56, 160 in combination with 161 or 162, 163–64, 165–66, 167–68, 170, 191–92; Fren 51–52, 60 in combination with 51 or 52, 91–92; Ger 51–52, 103–4, 111–12, 126, 161–62; Slav 91–92; Span 51–52, 91–92.

(c) 6 semester hours selected from Phil 111, 112, 113.

(d) 3 semester hours selected from Rel 9, 10, 21, 59, 60, 103, 104, 105, 107, 111, 113, 114, 115, 116, 126, 137, 143, 144, 145.

(e) 6 semester hours selected from Art 1, 31–32, 71–72, 101, 102, 103, 104, 105, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 140, 145, 147, 148, 149, 150, 155, 156, 161, 162, 165, 167, 169–70; Mus 3, 4, 7, 101–2, 103–4, 109, 110, 121, 125; SpDr 45, 49, 126, 143, 144, 165–66.

3. *Social Sciences*—18 semester hours:

(a) 6 semester hours selected from Hist 108, 109, 110, 111–12, 121, 122, 123–24, 171–72, 175–76, 179–80, 183.

(b) 6 semester hours selected from courses in economics; or 6 semester hours selected from courses in political science.

(c) 6 semester hours selected from courses in American civilization, anthropology, geography and regional science, psychology, or sociology.

4. *Natural and Mathematical Sciences*—18–22 semester hours:

(a) 6–8 semester hours in each of two laboratory sciences selected from BiSc 3–4 or 11–12; Chem 3–4 or 11–12; Geol 1–2 or 21–22; Phys 1–2 or 9–10.

(b) 6 semester hours selected from courses in mathematics (excluding Math 3 and 6).

5. *Electives*—41 semester hours of courses selected in consultation with the advisors.

A major is optional. If a student chooses a major, elective courses may be used to fulfill the requirements for it.

The requirement of 6 semester hours of literature in a foreign language may be fulfilled by selection from any of the first- or second-group foreign-language courses in literature. The requirement presupposes foreign-language competency which a student may achieve, if necessary, through elective courses.

A student must pass a minimum of 45 semester hours of second-group courses. By passing an examination administered or authorized by the appropriate department, a student may waive introductory courses that are prerequisite to more advanced courses.

GENETICS—GRADUATE PROGRAMS

Committee on Genetics

S.O. Schiff *(Chairman)*, W.F. Anderson, A.M. Attallah, D. Brusick, R. Crystal, R.F. De Giovanni-Donnelly, E.M. Earley, R.C. Gallo, C.B. Jacobson, D. Johnson, K.E. Johnson, P.D. Kind, K. Krell, A. Kumar, J.W. Larsen, W.M. Leach, R. Mage, C.R. Merril, A. Mescher, W.G. Nash, S. O'Brien, J.C. Petricciani, D. Picciano, K.N. Rosenbaum, M. Schanfield, J. Schlom, K. Todaro

The Graduate School of Arts and Sciences offers an interdepartmental program leading to the degrees of Master of Science and Doctor of Philosophy in the field of genetics. This program is directed by a committee whose members are drawn from the Departments of Anatomy, Biochemistry, Biological Sciences, Microbiology, Obstetrics and Gynecology; and from government agencies and private industry.

A baccalaureate degree and acceptable Graduate Record Examination scores are required for admission to the degree program. The undergraduate program must have included the following: eight semester hours each in biology, inorganic chemistry and organic chemistry; six semester hours in physics; and six semester hours in English composition and literature. While not required for admission, courses in embryology, genetics, and mathematics are strongly recommended.

Master of Science in the field of genetics—Required: the general requirements, pages 89–96. The 30 semester hours required in this program must include Gnet 201 and Gnet 299–300. The remaining 22 semester hours of course work are to be selected, with the approval of the Committee on Genetics, from the departmental courses listed below. The tool requirement may be met by satisfactorily completing an approved course in biostatistics or by passing a foreign language reading examination.

Doctor of Philosophy in the field of genetics—Required: the general requirements, pages 89–91, 96–99. The program of study must include Gnet 301, eight to 10 semester hours of biochemistry, six to eight semester hours of cell biology, 10 to 12 semester hours of genetics, and two or three semester hours of statistics. These courses may be selected from the departmental listings below. The tool requirement may be met by the satisfactory completion of an approved course in biostatistics and the passing of a foreign language reading examination, preferably in French or German.

GENETICS

Third Group

201 Advanced Problems in Genetics (2) **Staff**
Lectures on selected topics by members of the Committee on Genetics. Required of all master's degree candidates in the Genetics Graduate program. (Fall)

295 Research (arr.) **Staff**
Open to qualified master's degree students. Research on problems

approved by the Committee on Genetics. May be repeated for credit. (Fall and spring) Staff

299–300 **Thesis Research** (3–3) (Academic year)

Fourth Group Staff

301 **Advanced Problems in Genetics** (2) Staff
Lectures on selected topics by members of the Committee on Genetics. Required of all Ph.D. candidates in the Genetics Graduate program. (Fall)

398 **Advanced Reading and Research** (arr.) Staff
Limited to students preparing for the Doctor of Philosophy general examination. May be repeated for credit. (Fall and spring)

399 **Dissertation Research** (arr.)
Limited to Doctor of Philosophy candidates. May be repeated for credit. (Fall and spring)

ANATOMY

203 *Human Developmental Anatomy* (1)
260 *Electron Microscopy in Cellular Biology—Lecture* (1)
261 *Transmission Electron Microscopy* (3)

BIOCHEMISTRY

221–22 *General Biochemistry* (3–4)
229 *Biochemistry of Enzymes* (1)
232 *Protein Chemistry* (2)
250 *Cell and Molecular Biology* (3)
256 *Biochemical Genetics and Inherited Metabolic Diseases* (1 or 2)

BIOLOGICAL SCIENCES

Biology

111 *Introductory Microbiology* (4)
122 *Cell Biology* (3)
123 *Cell Biochemistry* (3)
124 *Cell Biochemistry Laboratory* (2)
127 *Genetics* (3)
128 *Genetics Laboratory* (1)
138 *Advanced Genetics* (3)
167 *Radiation Biology* (3)
206 *Seminar: Radiation Biology* (3)
220 *Seminar: Cell or Plant Biochemistry* (3)
227 *Seminar: Genetics* (3)
228 *Population Genetics* (3)
229 *Cytogenetics* (3)
230 *Human Genetics* (3)
248 *Analysis of Development* (3)
249 *Seminar: Developmental Biology* (3)

Zoology

145 *Introduction to Vertebrate Embryology* (4)

146 *Experimental Developmental Biology* (4)
212 *Seminar in Comparative Reproductive Biology* (3)

MICROBIOLOGY

211 *Microbiology* (4)
214 *Tissue Cell Culture* (3)
219 *Scientific Writing* (1)
229 *Immunology* (3)
230 *Immunology Laboratory* (2)
231 *Immunobiology* (1)
233 *Virology* (3)
234 *Virology Laboratory* (2)
258 *Microbial Genetics* (2)
260 *Cellular Immunology* (1)

PHARMACOLOGY

203 *Fundamental Principles of Pharmacology* (3)
222 *Genetic Toxicology* (2)
256 *Molecular Pharmacology* (2 or 3)
258 *Cancer Chemotherapy* (1)

STATISTICS

91 *Principles of Statistical Methods* (3)
127 *Statistics for the Biological Sciences* (3)

GEOBIOLOGY—GRADUATE PROGRAMS

Committee on Geobiology
A.G. Coates *(Chairman)*, M.A. Buzas, R.E. Knowlton, H. Merchant, A. Viterito

The Graduate School of Arts and Sciences offers an interdepartmental program leading to the degrees of Master of Science and Doctor of Philosophy in the field of geobiology. The program is directed by a committee whose members are drawn from the Departments of Biological Sciences, Geography and Regional Science, and Geology. It is enhanced by cooperative relationships with the Smithsonian Institution and U. S. Geological Survey.

A baccalaureate degree in biology, botany, geology, or zoology from this University, or an equivalent degree from another accredited institution of higher learning, is required for admission to the program. Prerequisite University courses (or equivalent courses elsewhere) include the following: BiSc 101 or 104, 108, 127, 140; Geol 22, 151 or 154, 166; Stat 91.

Master of Science in the field of geobiology—Required: the general requirements, pages 89–96. The program includes 30 semester hours of course work, plus a thesis (equivalent to six semester hours). Required courses include BiSc 107, 208, 209; Geol 195, 254, and 255. Electives are selected from the following (to total, with the required courses, at least 30 semester hours): BiSc 102, 103, 105, 106, 110, 138, 141, 143, 144, 162, 204, 207, 211, 228, 229, 237, 242, 243; Geog 104, 106, 108; Geol 105, 125, 128, 152, 154, 158, 163, 175, 181, 241, 258, 263, 266.

Doctor of Philosophy in the field of geobiology—Required: the general requirements, pages 89–91, 98–99. The program includes 48 semester hours of course work, plus a dissertation (equivalent to 24 semester hours). Required courses include: BiSc 107, 208, 209, 211, 228; Geol 125, 195, 254, 255, 263. Electives are to be selected from remaining elective courses listed for the master's degree (to total, with the required courses, at least 48 semester hours).

Research fields: animal ecology, evolution, genetics, geomorphology, hydrology, invertebrate zoology, invertebrate paleontology, lower plants, marine ecology, marine biology, meteorology, micropaleontology, paleoecology, plant ecology, sedimentary geology, stratigraphy, vertebrate paleontology, vertebrate zoology.

BIOLOGICAL SCIENCES

Biology

103 *Marine Biology*
107 *Field Biology*
138 *Advanced Genetics*
144 *Aquatic Ecology*
208 *Bioenergetics*
209 *Seminar: Principles and Mechanisms of Organic Evolution*
228 *Population Genetics*
229 *Cytogenetics*
243 *Seminar: Ecology*

Botany

105 *Field Biology of Woody Plants*
106 *Field Botany—Lower Plants*
110 *Comparative Plant Morphology*
141 *Plant Ecology*
242 *Seminar: Plant Ecology*

Zoology

102 *Advanced Invertebrate Zoology*
143 *Animal Ecology*
162 *Insect Population and Evolutionary Biology*
204 *Seminar: Invertebrate Zoology*
211 *Adaptation and Natural Selection*

GEOGRAPHY

104 *Special Techniques in Cartography*
106 *Introduction to Remote Sensing*
107 *Meteorology*
108 *Climatology*
220 *Seminar: Climatic Change*

GEOLOGY

105 *Geological Hazards in Land-Use Planning*
125 *Marine Geology*
128 *Geomorphology*

152 *Invertebrate Paleontology*
154 *Vertebrate Paleontology*
158 *Micropaleontology*
163 *Sedimentation*
175 *Hydrogeology*
181 *General Oceanography*
195 *Field Work*
241 *Marine Geochemistry*
253 *Applied Paleontology*
254 *Evolutionary Paleobiology*
255 *Quantitative Paleoecology*
258 *Seminar: Micropaleontology*
263 *Sedimentary Environments*
266 *Advanced Stratigraphy*

GEOGRAPHY AND REGIONAL SCIENCE

Professors M. Gordon, J.C. Lowe
Professorial Lecturers E. Marasciulo, J. Pickard
Associate Professors E.O. Pederson *(Chairman)*, A.K. Fitzsimmons
Assistant Professor A. Viterito
Assistant Professorial Lecturers S.E.S. Mastran, J. Fehrenbach, C.L. Weber, J. Banister

Bachelor of Arts with a major in geography (departmental)—The following requirements must be fulfilled:
1. The general requirements as stated on pages 71–72, 79–85.
2. Required courses in the major—Geog 1 or 2 and 3; 30 semester hours of second-group geography and regional science courses, including Geog 105, to be chosen in consultation with the undergraduate advisor.

Minor in geography—Required: one course from each of the following groups: cultural, population, and political geography: Geog 127, 145, 146; economic geography: Geog 2, 125, 141; physical geography: Geog 107, 108; resource management: Geog 132, 134, 135; urban geography: Geog 140, 142, 143.

Master of Arts in the field of geography—Prerequisite: a Bachelor of Arts degree with a major in geography from this University, or an equivalent degree. Required: the general requirements, pages 89–96. The minimum requirement consists of 30 semester hours of approved course work including a thesis; with the approval of the department, a student may elect a program of study without a thesis, but must then complete 36 hours of approved course work. A Master's Comprehensive Examination is required. Candidates must fulfill the tool requirement in one of three ways: (1) passing a reading knowledge examination in an approved foreign language; (2) satisfactorily completing six semester hours in statistics selected from Stat 105, 117, 118, 155, 159, 187, 188; or (3) satisfactorily completing Stat 106 and 110 (computer programming).

Master of Science and Doctor of Philosophy in the field of geobiology, see pages 315–17.

Associate in Science in Cartographic Science—The following requirements must be fulfilled:
1. The general requirement in English, as stated on pages 185–86.
2. Prerequisite: Cart 1 and 2.

3. Required courses in related areas: Math 31, 32; Geod 12, 17, 106; at least two courses in geology, physics, chemistry, or oceanography.
4. Required courses in the major: Cart 102, 104, 111, 115, 116, and 125 or 126. To remain in good standing and to qualify for graduation, a student must maintain an average grade of *B* in required courses in the major.
5. Electives selected in consultation with the advisor. Recommended: Cart 107, 120, 121, 131; Geod 110, 117, 150, 151.

Associate in Science in Geodesy—The following requirements must be fulfilled:

1. The general requirement in English, as stated on pages 185–86.
2. Prerequisite: Geod 17.
3. Required courses in related areas: Math 31, 32, 33, 124; Phys 1 or 3; Cart 107.
4. Required courses in the major: Geod 106, 110, 150, 160; at least one course selected from Geod 117, 151, 156, 161, 165–66. To remain in good standing and to qualify for graduation, a student must maintain an average grade of *B* in required courses in the major.
5. Electives selected in consultation with the advisor. Recommended: Math 139, 153, 157; Phys 161; Stat 157–58; Ocea 103, 105; Geol 1 or 3, 21.

Bachelor of Science in Cartographic Science—The following requirements must be fulfilled:

1. The general requirements as stated on pages 185–86.
2. Prerequisite: Cart 1 and 2.
3. Required courses in related areas: Math 31, 32, 33; Geod 12, 13, 17, 18, 106, 110. At least four courses selected from: Geol 1 or 3, 21; Phys 1 or 3, 14, 15; Chem 11–12; Ocea 103–4.
4. Required courses in the major: Cart 102, 104, 107, 108, 111, 115, 116, 120, 121, 125 or 126, and 131. To remain in good standing and to qualify for graduation, a student must maintain an average grade of *B* in required courses in the major.
5. Electives selected in consultation with the advisor. Recommended: Geod 117, 150, 156; Cart 113, 128; Phys 11–12; Ocea 11, 105; Math 124, 153.

Bachelor of Science in Geodesy—The following requirements must be fulfilled:

1. The general requirements as stated on pages 185–86.
2. Prerequisite: Geod 17 and 18.
3. Required courses in related areas: Phys 1 or 3, 15; Math 31, 32, 33, 124; Cart 107; Geol 1 or 3, 21; Ocea 103–4, 105.
4. Required courses in the major: Geod 106, 110, 150, 151, 160, 161; at least four courses from Geod 117, 156, 158, 165–66. To remain in good standing and to qualify for graduation, a student must maintain an average grade of *B* in required courses in the major.
5. Electives selected in consultation with the advisor. Recommended: Math 113, 139, 140, 141, 142, 153, 157; Phys 161, 162; Stat 106, 110, 114, 157–58.
6. Students considering graduate studies should acquire a reading knowledge of French, German, or Russian.

Bachelor of Arts in Education and Human Development with a teaching field in geography—Prerequisite: the education curriculum, pages 111–12.

Required: the geography option and the professional courses listed on page 115.

Master of Arts in Education and Human Development with a field in elementary or secondary education (specializing in geography)—Prerequisite: a bachelor's degree with sufficient concentration in geography to permit successful pur-

suit of graduate study in the Department of Geography and Regional Science. Candidates must be accepted by both the School of Education and Human Development and the Department of Geography and Regional Science.

Required: the general requirements, pages 124-26, including 15 semester hours of graduate courses in geography and regional science.

GEOGRAPHY AND REGIONAL SCIENCE

First Group

1 Introduction to Geography (3) — **Staff**
A systematic survey of human geography, stressing the organization of space and the role of the environment. (Fall and spring)

2 Introduction to Economic Geography (3) — Staff
Examination of the basic principles which determine the location of economic activities. (Spring)

3 Introduction to Physical Geography (3) — Viterito
A study of the earth's physical environment, its systems, subsystems, and physical processes. Laboratory fee, $22. (Fall)

***91 East Asia—Past and Present** (3) — Johnson and Associated Faculty
An interdisciplinary course, introducing the student to a comprehensive and integrated understanding of the civilization and present problems of East Asia.

Second Group

104 Special Techniques in Cartography (3) — Staff
Descriptive and statistical techniques for thematic mapping; computer cartography. Laboratory fee, $22. (Spring)

105 Scope and Methods of Geography (3) — Pederson, Viterito
Nature of geographical inquiry, approaches to the study of geography, empirical research methods. Admission by permission of instructor. (Fall)

106 Introduction to Remote Sensing (3) — Viterito
Examination of the principles and applications of remote sensing techniques using aerial photography and satellite imagery. Laboratory fee, $22. (Fall)

107 Meteorology (3) — **Viterito**
Atmospheric dynamics, systems, and controls. Laboratory fee, $22. (Spring)

108 Climatology (3) — **Viterito**
Analysis of climatic regions and systems of climatic classification; examination of human-climatic relationships. Laboratory fee, $22.

110 Geography of Desertification (3) — Viterito
Man, climate, and change in arid regions.

115 Field Program in Mesoamerican Archaeology and History (6) — Humphrey, Mergen
Same as AmCv/Anth 115.

124 Urban Transportation (3) — **Lowe**
The relationship between freight and passenger transportation systems and urban land use patterns and structure.

125 Transportation Geography (3) — **Lowe**
The structure and evolution of transportation and communication networks and their impact on regional development. (Fall)

* An interdepartmental course offered by the Geography and Regional Science, East Asian Languages and Literatures, Economics, History, Philosophy, Political Science, and Religion Departments.

127 **Population and Settlement** (3) Gordon
Patterns of world population; factors contributing to population pressures, growth, and migrations. (Spring)

132 **Resource Management and Conservation** (3) Staff
Principles and practices in effective utilization of resources in the United States and selected areas; public policies relating to conservation; environmental systems, perception, and impact studies. (Fall)

133 **Food and Regional Development** (3) Gordon
Spatial aspects of food production and agricultural development. (Fall)

134 **Geography of Energy Resources** (3) Staff
Analysis of regional patterns and trends in consumption and production of energy resources. Examination of international energy linkages and energy policies of selected nations.

135 **Resources and Environmental Quality** (3) Staff
Investigations into questions of resource use and environmental quality. Emphasis on public policy and societal attitudes as they influence man's use of resources. (Spring)

136 **Geography of Water Resources** (3) Viterito
Investigation of the hydrologic cycle, focusing on precipitation, infiltration, and surface runoff. Laboratory fee, $22. (Spring)

137 **Environmental Hazards** (3) Viterito
Examination of natural hazards in terms of their types, distributions, and impacts on human activities. (Spring)

140 **Urban Geography** (3) Pederson
Analysis of the internal spatial structure of cities; emphasis on explaining patterns of location within the city. (Fall)

141 **Urban Settlement** (3) Pederson
The location of cities, urbanization processes, theories and models of urban location and development. (Spring)

142 **Urban Environments** (3) Lowe
Perspectives on urban service delivery and the physical geography of the city.

143 **Social Geography** (3) Lowe
Behavioral perspectives on human spatial activities in cities.

145 **Cultural Geography** (3) Staff
Analysis of the relationships between culture and environment; emphasis on spatial and ecological considerations. (Spring)

146 **Political Geography** (3) Pederson
Interrelationships among the human and physical environment and political systems; the organization of political territories. (Fall)

151 **Geography of U.S. and Canada** (3) Staff
An examination of the social, environmental, and economic factors which have led to development of the several regions of the U.S and Canada.

154 **Geography of the Middle East** (3) Gordon
Cultural and physical regional patterns of the Middle East. (Fall)

161 **Geography of Latin America** (3) Gordon
Examination of spatial characteristics of physical and cultural phenomena in Middle and South America. (Fall)

189–90 **Readings in Geography** (arr.) Staff
(Academic year)

198 **Topics** (3) Staff
Consideration of geographic aspects of topical and future problems of society. May be repeated for credit provided that the topic differs.

199 **Practicum** (3) Staff
Field work, internship or other controlled assignment with an agency or organization engaged in work in applied geography.

Third Group

219 **Seminar: Climatology** (3) Viterito
Atmospheric circulation systems, controls, and distribution. Elements of synoptic climatology, including climate modeling.

220 **Seminar: Climatic Change** (3) Viterito
Climatic history; examination of natural and induced climatic change. (Spring)

222 **Seminar: Resources and the Environment** (3) Staff
Analysis of the spatial variations and interrelationships of resources and the environment. (Fall)

223 **Seminar: The Population-Food Balance** (3) Gordon
Spatial problems associated with the dynamics and interaction of population growth and agricultural output.

224 **Seminar: Political Geography** (3) Pederson
Examination of the political factor in location theory and analysis of the nature of political territories. (Spring)

225 **Seminar: Transportation Geography** (3) Lowe
Transportation and communication in the organization of space. (Fall)

230 **Seminar: Spatial Implications of Resource and Environmental Policy** (3) Staff
A consideration of the differential regional implications of and responses to resource and environmental policy decisions owing to regional differences in societal and physical parameters.

243 **Seminar: Urban Geography** (3) Lowe
Evolving morphology and internal spatial patterns of cities.

244 **Seminar: Urban Systems** (3) Pederson
Central place theory and other theories of urban location and the organization of systems of cities.

250 **Regional Development** (3) Gordon
Geographic perspectives on the policy, planning, and programmatic aspects of regional development. (Spring)

261 **Seminar: Geography of Latin America** (3) Marasciulo
Selected topics related to population, environment, and land use in Latin America. (Fall)

265 **Seminar: Geography of the Soviet Union** (3) Weber
Survey of USSR regions and major topical themes of Soviet geography, including population, energy, agriculture, transportation, and regional development. (Spring)

268 **Seminar: Geographic Perspectives on Contemporary China** (3) Banister
China's development prospects: environmental constraints, population growth, and regional differences in context of Chinese cultural patterns and political organization. (Fall)

287 **Seminar: Problems in Latin American Civilization** (3) Staff
Same as Anth/Econ/Hist/Rom 287, and PSc 285. Interdisciplinary seminar; each student writes a report on some aspect of a selected key theme. May be repeated for credit. Admission by permission of instructor. (Fall and spring)

290 **Principles of Demography** (3) Boulier
Same as Econ 290.

291 **Methods of Demographic Analysis** (3) Boulier
Same as Econ 291.

295 **Research** (arr.) **Staff**
May be repeated for credit. (Fall and spring)

299–300 **Thesis Research** (3–3) **Staff**
(Fall and spring)

CARTOGRAPHY*

1 **Cartography I** (3)
Introduction to the fundamental concepts and practical applications of cartography. Prerequisite: Math 3, 6, or equivalent.

2 **Cartography II** (3)
Aerial photography, modern topographic and hydrographic mapping and charting, thematic maps, map reliability, planning and design, and reproduction. Prerequisite: Cart 1.

102 **Elements of Remote Sensing** (3)
Basic elements of remote sensing. Emphasis on the electromagnetic spectrum, infrared photographic systems, thermal systems, and analysis of multispectral photography and thermal imagery. General characteristics of satellite remote sensing. Prerequisite: Cart 1 and 2 (or equivalent experience), Geod 17, and Math 31.

104 **Photo-interpretation** (3)
Interpretation of topographic, vegetative, hydrologic, and man-made features. Civil and military applications. Applications to urban planning and urban-industrial patterns. Use of satellite imagery and remote sensing data. Color aerial photographs and underwater photography. Prerequisite: Cart 102, Geod 17, Math 31.

107 **Physiography** (3)
Development of physiographic concepts; the earth's crust, weathering, climate, and denudation; stream, shore, wind, and ice processes; glaciation; physiographic regions.

108 **Climatology** (3)
Causes for climate and weather, air mass movements, water mass movements, physical features of boundaries. Tropics, subtropics, humid and dry continentals, subarctics.

111 **Cartographic Techniques** (3)
Techniques and procedures, field methods, evaluation of source material, use of scribing and contact screens in color separation, shaded relief, and reproduction. Lectures and laboratory. Prerequisite: Cart 2, Geod 12, Math 3, 6 (or equivalent experience). Material fee, $21.

113 **Map Design** (3)
Functional requirements of various kinds of maps. Principles of human perception and visual communication. Influence of reproduction processes on map design. Optimizing results within constraints of available source material, equipment, time, money, manpower, and reproduction process. Changing tradition of map design. Influence of experimental work and progress in the commercial and fine arts on map design. Role of map design in mapping organizations. Prerequisite: Cart 107 and 111.

115 **Cartometrics I** (3)
Examination of the application of automatic computing systems to cartography. Course will cover batch processing and time sharing

* Courses are offered off campus only.

and dedicated minicomputer systems as well as digitizers, plotters, and graphic terminals. Prerequisite: Cart 1, 2.

116 **Cartometrics II** (3)
Analysis of cartographic computing programs, cartographic data structures, and automated mapping data bases. Examination of FORTRAN programming methods as they apply to cartography. Preparation of coordinate transformation programs, map projection programs, and plotting software. Prerequisite: Cart 115, Geod 106, or equivalent experience. Laboratory fee for computer use.

120 **Computer Mapping I** (3)
The analysis and application of computer mapping methods; techniques for the automation of data bases and the creation of computer generated map output. Students will develop application programs in laboratory sessions. Prerequisite: Cart 115, 116. Laboratory fee for computer use.

121 **Computer Mapping II** (3)
Advanced applications of computer mapping methods and applications that include 2- and 3-dimensional automated plotter programs. Course will include laboratory sessions and students will develop an advanced seminar project. Prerequisite: Cart 120. Laboratory fee for computer use.

125 **Marine Cartography** (3)
Exploring the extended and imaginative symbology required to depict a visually opaque environment characterized by sparsity of data: the thematic aspects of oceanographic mapping. Prerequisite: Cart 2.

126 **Topographic Mapping** (3)
Application of control surveys and photogrammetry to topographic mapping. National Map Accuracy Standards. Systematic application of geographic names. Field completion. Feature classification and symbolization. Map compilation and color separation. Comparison of American and foreign topographic maps and methodologies. Prerequisite: Cart 107, 111; Geod 12, 13.

128 **Thematic Mapping** (3)
Analysis of the thematic map as a means of communicating qualitative and quantitative data. The function and design of base maps for thematic overprints. Source material research, analysis, and manipulation. Map layout and symbol design. Experimental studies to compare the data the cartographer intends to communicate with the map and that actually extracted by the reader. Prerequisite: Math 31, Cart 111, and Geod 106.

131 **Techniques in Remote Sensing** (3)
The application of remote sensing to earth resource studies with emphasis on the physical characteristics of electromagnetic radiation, multispectral sensing, and photographic and digital image analysis. Satellite systems and the cartographic treatment of remote sensing data. Prerequisite: Cart 102, Math 31, and Phys 1 or 3.

GEODESY*

12 **Plane Surveying** (3)
Basic plane surveying for cartographers and surveyors. Field exercises as arranged. Prerequisite: Math 30.

13 **Higher Surveying** (3)
Elements of geodetic and hydrographic surveying for cartographers

* Courses are offered off campus only.

and surveyors. Field exercises as arranged. Prerequisite: Geod 12 and Math 32.

17 **Elementary Photogrammetry** (3)
Fundamentals of aerial photography, photogrammetric optics, and photographic processes; mathematics of vertical and tilted photographs; stereoscopy and parallax; planning and executing the photogrammetric project; radial triangulation methods; photomaps; oblique and terrestrial photography. Prerequisite: Geod 12, Math 31.

18 **Intermediate Photogrammetry** (3)
Basic theory and practices. Stereoscopic plotting instruments; graphical and computational methods for adjusting strips of aerotriangulation. Method of least squares, statistics and transformations applied to photogrammetry. Prerequisite: Geod 17.

106 **Physical Science Data Analysis** (3)
Elementary analysis of cartographic, geodetic, and oceanographic data. Basic concepts of probability, sample statistics, probability distributions, confidence intervals, estimation, and tests of hypotheses as related to cartographic, geodetic, and oceanographic data. Prerequisite: Math 31, and either Cart 1–2 or Geod 150–51.

110 **Map Projections** (3)
Elementary theory of projections in cartography and geodesy. Projection of the sphere and ellipsoid on plane, conical, and cylindrical surfaces. Prerequisite: Math 33.

117 **Analytic Photogrammetry** (3)
Analytic photogrammetry theory and practice: matrix algebra, method of least squares, image coordinate refinement, formulation for analytic photogrammetry, intersection, linearization of equations, space resection, two- and three-photo relative orientation, strip adjustment review, block adjustment. Prerequisite: Math 32, Geod 18.

150 **Geometric Geodesy** (3)
Principles and formulas basic to theoretical and applied geodesy. Primary emphasis on geometric methods. Prerequisite: Math 33.

151 **Physical Geodesy** (3)
Physical and celestial methods and application of geodesy. Prerequisite: Geod 150, Phys 1 or 3, Math 33.

156 **Geodetic Astronomy** (3)
Astronomic determination of longitude, time, azimuth, and latitude. Prerequisite: Math 32, Geod 150.

158 **Electronic Surveying and Navigation** (3)
An examination of the principles and applications of techniques. Topics include: EM wave propagation, system error identification and analysis, representative surveying systems, baseline radio navigation systems, and long line calculations and transformation techniques. Prerequisite: Math 32; Phys 1; Cart 1 or Ocea 11.

160 **Adjustment Computations I** (3)
Basic adjustment theory. Prerequisite: Geod 106, 150; Math 32, 124.

161 **Adjustment Computations II** (3)
Topics in advanced adjustment theory. Applications to geodesy and photogrammetry. Prerequisite: Geod 160.

165–66 **Space Techniques for Geodesy** (3)
Determination of the gravitational field, station positions, and fundamental physical constants. Basic celestial mechanics, computing techniques, and data analysis. Modern data acquisition systems. Prerequisite: Math 33, 124; Geod 150, 151.

OCEANOGRAPHY*

11 Navigation (3)
Theory of nevigation, charts, navigation aids, celestial navigation, shipboard instruments. Prerequisite: one course in college algebra and trigonometry; Engl 10.

103–4 General Oceanography (3–3)
Ocea 103: general circulation of the oceans: waves, tides, and properties of sea water; history and methods. Ocea 104: topography and sediments of the ocean floor; life in the sea; and interrelationships of the marine sciences. Field trips as arranged. Each course may be taken independently.

105 Elementary Geophysics (3)
Gravity, geomagnetism, and seismology in cartography, geodesy, and oceanography. Prerequisite: Math 32; Phys 1 or 3.

GEOLOGY

Professors G. Teleki *(Emeritus)*, G.V. Carroll, F.R. Siegel *(Chairman)*, A.G. Coates, R.C. Lindholm, J.F. Lewis
Adjunct Professors J.W. Pierce, I.G. Sohn, M.A. Buzas, W. Back
Professorial Lecturers N. Hotton, D. Appleman, J.T. Hack, C.B. Cecil
Associate Professor G.C. Stephens
Associate Professorial Lecturers A. Geiger, M.D. Turner
Assistant Professorial Lecturers F.J. Collier, J. Mercer, C.C. Smith, R.W. Stanton
Lecturer R.T. Rye

Bachelor of Arts or Bachelor of Science with a major in geology (departmental)—The following requirements must be fulfilled:
1. The general requirements as stated on pages 71–72, 79–85.
2. Required introductory course—Geol 21–22.
3. Required courses in related areas—(a) Chem 11–12; (b) Math 30 (for the degree of Bachelor of Arts) or Math 30 and 31 (for the degree of Bachelor of Science); (c) Stat 91; and (d) BiSc 11 or 101 or Phys 1 or 3 (for the Bachelor of Arts); BiSc 11 or 101, *and* Phys 1 or 3 (for the Bachelor of Science).
4. Required courses in the major—Geol 111, 112, 117, 118, 122, 123, 151–52 for both the degree of Bachelor of Arts and Bachelor of Science; Geol 128, 166, 189, 195 for the Bachelor of Science degree only.

Bachelor of Science with a major in geology—engineering option (engineering geology) (departmental)—An interdisciplinary curriculum offered by the Geology Department and the Civil, Mechanical, and Environmental Engineering Department in the School of Engineering and Applied Science. [Students wishing to work toward the degree of Bachelor of Science [Civil Engineering] with a geology option [geotechnical engineering] should consult the *School of Engineering and Applied Science Bulletin.)* The following requirements must be fulfilled:
1. The general requirements as stated on pages 71–72, 79–85.
2. Required introductory courses—ApSc 57, 58; Chem 13; EE 51; Geol 21–22; Math 31, 32, 33; Phys 14, 15, 16; or equivalents.
3. Required courses in the major: CE 120, 140, 166, 167, 168, 182, 185; Geol 111–12, 117, 118, 122, 175, 189, 195, and one course chosen from Geol 128, 141, or 163; Math 111, 112; ME 126, 131; Stat 91 or 102 or ApSc 115.

* Courses are offered off campus only.

Minor in geology—18 semester hours selected with approval of the departmental advisor to undergraduates, including 6 hours of introductory geology (Geol 1–2; 5 and 105; 21–22); two courses selected from Geol 111, 122, 151; and two from Geol 110, 125, 128, 154, or from requirements of the B.A. and B.S. (For students with special interdisciplinary interests, substitutions can be arranged.)

Master of Science in the field of geology—Prerequisite: the degree of Bachelor of Arts or Bachelor of Science with a major in geology from this University, or an equivalent degree, and the Graduate Record Examination.

Required: the general requirements, pages 89–96. Master of Sciences degree candidates must include in their program of study Geol 141, 163, 205, and 272. Geol 299–300 *Thesis Research* is required. Candidates must pass a Master's Comprehensive Examination before submitting their thesis work. A reading knowledge examination in an approved foreign language must be passed. With the permission of the department, candidates in the Master of Science program may substitute another approved tool subject in lieu of the foreign language requirement.

Master of Arts in the field of geology—a 33-hour non-thesis option. Prerequisite: the degree of Bachelor of Arts or Bachelor of Science with a major in geology from this University, or an equivalent degree.

Required: the general requirements, pages 89–96. Master of Arts degree candidates must take Geol 128, 141, 163, 175, 189, 205, 219, 266, 272, and 295; two electives must be taken from Geol 216 or 263, 220 or 224, 241 or 243, and 253 or 255. Candidates must pass a Master's Comprehensive Examination. A reading knowledge examination in an approved foreign language must be passed. With permission of the department, candidates may substitute another approved tool subject in lieu of the foreign language requirement.

Master of Science in the field of geochemistry (an interdepartmental degree offered by the Departments of Geology and Chemistry)—Prerequisite: a Bachelor's degree with a major in geology or in chemistry from this University, or an equivalent degree.

Required: the general requirements, pages 89–96, including Chem 111–12; Geol 141, 241 or 243, 249; Chem 213; and Geol 299–300. The Master's Comprehensive Examination must be taken before registration for the second half of the thesis work. A reading knowledge examination in a foreign language, approved by the Departments of Geology or Chemistry, must be passed.

Master of Science in the field of engineering geology—An interdisciplinary degree offered by the Geology Department and the Civil, Mechanical, and Environmental Engineering Department in the School of Engineering and Applied Science.

Prerequisite: A Bachelor of Science degree in geology or a Bachelor of Science (Civil Engineering) degree from this University or an equivalent degree which must include those courses or their equivalents as outlined for the undergraduate requirements in the field of geology with the engineering option (engineering geology). With the permission of the department, a student may elect a program of study consisting of 36 semester hours of approved course work without a thesis. (Students wishing to work toward a Master of Science in the field of geotechnics and foundation engineering should consult the *School of Engineering and Applied Science Bulletin*). Each program is arranged to fit the students' needs and interests. Either hydrogeology or engineering geology may be chosen as the field of specialization.

Required: (a) The general requirements, pages 89–96; (b) geology—at least 12 semester hours to include Geol 128, 141, 163, and 205; (c) engineering and physical science—at least 12 semester hours, which may include up to 3 semester hours of approved undergraduate civil engineering courses (12 for

non-thesis candidates), the remainder to be selected from ApSc 211, 213; CE 204, 205, 206, 207, 208, 209, 214, 216, 219, 255, 256, 257, 265, 271; ME 221, 227, 231, 261, 262; EngS 212, 213, 214, 218, 221, 228, 230, 231, 233, 236. The tool subject requirement is the same as for the Master of Science in the field of geology above.

Master of Science and Doctor of Philosophy in the field of geobiology, see pages 315–17.

Doctor of Philosophy in the field of geology—Required: the general requirements, pages 89–91, 96–99, including passing a reading knowledge examination in an approved foreign language and one other approved tool subject; and the satisfactory completion of the General Examination in three fields, one of which must be in petrology, stratigraphy, or structural geology.

Research fields: geomorphology, marine geology, mineralogy, paleontology, petrology, sedimentology, stratigraphy, structural geology, geochemistry, geophysics, and hydrogeology.

Doctor of Philosophy in the field of geochemistry (an interdepartmental degree offered by the Geology and Chemistry Departments)—Required: the general requirements, pages 89–91, 96–99, including passing a reading knowledge examination in an approved foreign language plus the satisfactory completion of Stat 117 and 118, or 91; and the satisfactory completion of the General Examination in four fields, including geochemistry and chemistry.

Bachelor of Arts in Education and Human Development with a teaching field in earth science—Prerequisite: the education curriculum, pages 111–12. Required: the earth science option and the professional courses listed on page 115.

First Group

1–2 **Introductory Geology for Nonscience Majors** (3–3) Carroll, Stephens, Coates
An introduction, for nonscience majors, to the principle features of the composition, structure, and history of the earth. Topics include nature of minerals and rocks, physical processes, energy resources, continental drift, origin of life, and evolution. Lecture (2 hours), laboratory (2 hours). Laboratory fee, $20 per semester. (Academic year)

5 **Environmental Geology** (3) Siegel, Lindholm
The relation of people and society to natural environments; population evolution, natural hazards, and mineral resources; economic, legal, and political aspects. Laboratory fee, $18. (Fall and spring)

21–22 **Physical and Evolutionary Geology** (3–3) Lindholm, Lewis
Lecture and laboratory (5 hours). Principles of geology as a base for further study in geology and related sciences. Laboratory fee, $20 per semester. Admission by permission of instructor. (Academic year)

Second Group

101 **History of Geological Sciences** (3) Teleki
Development of scientific thought; history of geological and related sciences. (Spring)

105 **Geological Hazards in Land-Use Planning** (3) Siegel
An analysis of geological hazards and related factors that affect land-use planning. Field trip. Prerequisite: Geol 5 or 21, or permission of instructor. Laboratory fee, $10. (Spring)

110 **Mineralogy and Petrology for Environmental Sciences, Oceanography, and Fields Allied to Geology** (3) Carroll
Lecture and laboratory. Prerequisite: permission of instructor. Laboratory fee, $10. (Spring)

111 **Mineralogy** (4) Carroll
Lecture and laboratory. Morphological crystallography and systematic mineralogy. Prerequisite: Geol 1 or 21. Laboratory fee, $20. (Spring)

112 **Crystal Optics** (4) Carroll
Lecture and laboratory. Optical phenomena of crystals and uses of the polarizing microscope. Prerequisite: Geol 111. Laboratory fee $24. (Fall)

113 **Crystallography** (3) Appleman
Point-group and space-group theory, fundamentals of crystal structure, x-ray diffraction theory and application. Prerequisite: Math 31 Laboratory fee, $15. (Alternate academic years)

117 **Petrology** (2) Lewis
Introduction to silicate phase systems; physics and chemistry of crustal and magmatic processes; volcanic processes and products Prerequisite: Geol 21, 111–12; Phys 1 or equivalent; or permission of instructor. (Spring)

118 **Petrology Laboratory** (2) Lewis
Concurrent registration in Geol 117 required for geology majors Prerequisite: Geol 111. Laboratory fee, $24. (Spring)

122 **Structural Geology** (3) Stephens
Study of natural and experimental rock deformation and the relationship between stress and strain as recorded by geologic structures Prerequisite: Geol 22. (Fall)

123 **Structural Geology Laboratory** (1) Stephens
Solution of geometrical problems of structural geology. Prerequisite or concurrent registration: Geol 122. Laboratory fee, $10. (Fall)

124 **Geologic Map Interpretation** (2) Stephens
Interpretation and analysis of geologic maps and cross sections Laboratory fee, $5. (Spring)

125 **Marine Geology** (3) Pierce
Lecture and map work. Principles of oceanography and submarine geology; topography, crustal structure, sedimentary processes, and marine environment. Prerequisite: Geol 1–2 or 21–22; or permission of instructor. (Spring)

128 **Geomorphology** (3) Hack
Lecture (2 hours), laboratory as arranged. Nature and evolution of earth forms; principles of photointerpretation. Prerequisite: Geol 21 Laboratory fee, $10. (Spring)

132 **Economic Geology** (3) Turner
Genesis and distribution of mineral raw materials and their uses. Prerequisite: Geol 111. (Fall)

136 **Engineering Geology** (3) Geiger
For students in the School of Engineering and Applied Science. Geological principles and processes and their application to civil and mechanical engineering. Prerequisite: Math 31; Phys 2 or 4; or permission of instructor. Laboratory fee, $10. (Spring)

141 **Introductory Geochemistry** (3) Siegel
Principles and theories on the abundance, relationships, and distribution of the elements in various rock and mineral species. Prerequisites or concurrent registration: Geol 117 or equivalent; Chem 11–12

Math 31; Phys 1 or 3; or permission of instructor. Laboratory fee, $10. (Fall)

151–52 **Invertebrate Paleontology** (3–3) Coates
Biology, taxonomy, functional morphology, and evolutionary patterns of the invertebrate fossil groups, with emphasis on the macroinvertebrates. Prerequisite: Geol 1–2 or 21–22; or permission of instructor. Laboratory fee, $18 per semester. (Academic year)

154 **Vertebrate Paleontology** (3) Hotton
Lecture (2 hours), laboratory or field work as arranged. General features of vertebrate morphology and evolution; problems of paleoecology and adaptation. (Fall, odd years)

158 **Micropaleontology** (3) Staff
Biology, morphology, paleoecology, biogeography, and biostratigraphy of marine and non-marine phosphatic, organic, siliceous, and calcareous microfossils. (Fall, even years)

163 **Sedimentation** (4) Lindholm
Lecture and laboratory, field trips as arranged. Principles of sedimentation, analysis and interpretation of sedimentary processes and environment. Prerequisite: Geol 112; Stat 91; or permission of instructor. Laboratory fee, $20. (Fall)

166 **Principles of Stratigraphy** (3) Coates
Fundamentals of stratigraphic principles and practice. Review of historical concepts, section measuring, vertical and lateral lithostratigraphic relationships, magnetic and climatic stratigraphy, biostratigraphic classification, zonation, correlation, geochronology, facies, and stratigraphic maps. Prerequisite: Geol 151–52 or permission of instructor. (Fall)

168 **Geology of Coal** (3) Stanton, Cecil
Geologic setting, petrography, and physical/chemical characteristics of coal. Prerequisite: Geol 117, 118, and 163. Alternate academic years. (Spring)

175 **Hydrogeology** (3) Back
The occurrence, storage, movement, quality, and problems of pollution of subsurface water, and the hydrologic properties of water-bearing materials. Prerequisite: Geology 111, 122; Math 31; Chem 11–12; or permission of instructor. (Spring)

189 **Geophysics for Geologists** (3) Stephens
Basic geophysics to assist the geologist mapping and solving geologic problems. Prerequisite: Geol 21–22; Math 31; Phys 1 or 3; or permission of instructor. (Spring)

195 **Field Work** (2) Staff
Weekend field trips. Surveying, geological mapping, and specific field work methods. Students will be responsible for room and board expenses while at field camp. Laboratory fee (field trip fee), $10. (Spring)

199 **Undergraduate Research or Reading** (arr.) Staff
Problems approved by the staff. May be repeated once for credit. (Fall and spring)

Third Group

205 **Seminar in Geology** (1) Staff
Special topics each semester. May be repeated for credit.

216 **Sedimentary Petrography** (3) Lindholm
Identification, classification, and interpretation of common sedimentary rocks by means of the petrographic microscope. Prerequisite:

Geol 112, 163; or permission of instructor. Laboratory fee, $20. (Spring)

219 **Petrogenesis I** (3) Lewis
The origin of selected igneous and metamorphic rock types. Laboratory fee, $20. (Fall)

220 **Petrogenesis II** (3) Lewis
Laboratory fee, $20. (Spring)

224 **Advanced Structural Geology** (3) Lewis
Rock deformation. Methods of study and the formation of structurally complex rock. Tectonics. Prerequisite: Geol 122 or permission of instructor. (Fall, odd years)

241 **Marine Geochemistry** (3) Siegel
Chemical composition and physical properties of sea water, chemical composition and alterations of marine sediments, thermodynamics and biochemical activity in oceans. Methods of analysis and problems of measuring. Prerequisite: Geol 141, Math 31, or permission of instructor. Recommended: Chem 22. Laboratory fee, $18. (Spring, even years)

243 **Geochemical Prospecting** (3) Siegel
Application of geochemical principles and analyses to the detection of hidden ore deposits. Field trips as arranged. Prerequisite: Geol 141. Laboratory fee, $20. (Spring, odd years)

249 **Seminar: Geochemistry** (2) Staff
Independent topics each semester; may be repeated for credit.

253 **Applied Paleontology** (3) Coates and Staff
Fundamentals of paleoecology using case histories from a wide variety of fossil invertebrate and vertebrate groups. Includes functional morphology of the individual organism, analysis of paleopopulations, paleocommunities and paleobiogeographic provinces and realms. Relationship of faunal and floral paleobiogeographic units to plate tectonics and uses of different fossil groups in tectonics, paleoclimatology, paleobathymetry, paleochronology, and related topics will be discussed. (Fall, odd years)

254 **Evolutionary Paleobiology** (3) Coates
Consideration of modern evolutionary theory with emphasis on the fossil record. (Spring, odd years)

255 **Quantitative Paleoecology** (3) Buzas
Characteristics of populations applicable to the fossil record. Subject matter includes ecosystem concept, habitat, Hutchinsonian niche, life-death, size-frequency distributions, competitive exclusion principle, spatial distributions, relative abundance and diversity, quantification of community biofacies. Prerequisite: Geol 151–52, Stat 91, or permission of instructor. (Fall, odd years)

258 **Seminar: Micropaleontology** (3) Staff
Prerequisite: Geol 158 or permission of instructor. May be repeated for credit. (Fall, even years)

263 **Sedimentary Environments** (3) Lindholm
Study of selected depositional environments. Field trips as arranged. Prerequisite: Geol 163; Stat 91. Laboratory fee (field trips), $15. (Fall, even years)

266 **Advanced Stratigraphy** (3) Coates and Staff
Analysis of special topics in stratigraphy. Historical background, concept of facies, cycles of sedimentation, clastic and carbonate subsurface lithofacies, subsurface biostratigraphy, ecological and evolutionary attributes of stratigraphically useful organisms, quanti-

tative methods, isochronology, geochronology, and magnetic-stratigraphy. (Spring, even years)

272 **Regional Geology** (2) Carroll

295 **Research** (arr.) Staff
Research on problems approved by the staff. Open to qualified students with advanced training. May be repeated for credit. (Fall and spring)

299–300 **Thesis Research** (3–3) Staff
(Fall and spring)

Fourth Group

398 **Advanced Reading and Research** (arr.) Staff
Limited to students preparing for the Doctor of Philosophy general examination. May be repeated for credit. (Fall and spring)

399 **Dissertation Research** (arr.) Staff
Limited to Doctor of Philosophy candidates. May be repeated for credit. (Fall and spring)

GERMANIC LANGUAGES AND LITERATURES

Professors J.C. King, K. Thoenelt *(Chairman)*, C. Steiner
Associate Professorial Lecturer P. Werres
Assistant Professorial Lecturer E.M. Pulgram
Lecturer L. Melbourne

Bachelor of Arts with a major in Germanic languages and literatures (departmental)—The following requirements must be fulfilled:

1. The general requirements as stated on pages 71–72, 79-85.
2. Prerequisite courses—Ger 1–2, 3–4, 9–10, 51–52; or equivalent.
3. Required courses in other areas—six semester hours of history, and six semester hours in one of the following subjects: art history, music history, or philosophy.
4. Requirements for the major—a minimum of 24 semester hours in German courses above the first group, including Ger 179–80; reasonable proficiency in speaking, reading, and writing German.

Minor in German—Required: 12 semester hours of second-group courses, including Ger 179–80 and one two-semester course in German literature taught in German. Prerequisite: Ger 1–4, 9–10, 51–52, or equivalent.

Bachelor of Arts in Education and Human Development with a teaching field in German—Prerequisite: the education curriculum, pages 111–12.
Required: the German option and the professional courses listed on page 115.

Placement Examination: A student who has not been granted advanced standing and who wishes to continue in college the language begun in high school must take a placement examination before registration. Upon completion of the examination, assignment is made to the appropriate course.

GERMAN

First Group

1–2 **First-year German** (3–3) Staff
Fundamental concepts of German culture; essentials of German structure and basic vocabulary; reading of easy prose and conversation. Aural-oral practice in language laboratory. Laboratory fee, $17.50 per semester. Prerequisite to Ger 2: Ger 1. (Fall and spring)

*3–4 **Second-year German** (3–3) Staff
Introduction to German civilization; selections from modern German prose; continuation and review of German structure; conversation and simple composition. Aural-oral practice in language laboratory. Laboratory fee, $17.50 per semester. Prerequisite to Ger 3: Ger 1–2 or equivalent. Prerequisite to Ger 4: Ger 3. (Fall and spring)

*9–10 **German Conversation and Composition** (3–3) Steiner
(Academic year)

47 **Beginning German for Reading Acquisition** (3) Staff
For undergraduates and graduate students with little or no German who are interested in acquiring a reading knowledge of German. No academic credit for graduate students. (Fall)

49 **German Readings for Nonmajor Students** (3) Staff
Primarily for graduate students preparing for reading examinations. undergraduates admitted. No academic credit for graduate students. Prerequisite: Ger 4 or 47, or equivalent. (Spring)

51–52 **Introduction to German Literature—in English** (3–3) Staff
Lecture, recitation, and discussion. Selected readings in German literature from the earliest periods to the present. (Academic year)

Second Group

103–4 **Major Themes of German Literature—in English** (3–3) Thoenelt
Topics for 1982–83: Ger 103—The Faust myth in Western literature Faust, or man's pursuit of happiness: its religious, political, and aesthetic possibilities and limitations. The original sin in the Bible; Faust in classical and Germanic mythology; modern Faust-figures in the works of Rousseau, Goethe, Dostoevsky, Stephen Vincent Benét, Paul Valery, Hemingway, Thomas Mann, and Camus. Ger 104—Literature and politics in Germany: *Kultur* and politics, the two faces of Germany. A survey of these two aspects of German history and German life. Selected readings from relevant literary and political documents by Walther v. d. Vogelweide, Kant, W. v. Humboldt, Frederick II, Mme. de Staël, Goethe, Schiller, Marx, Heine, Nietzsche, Thomas Mann, Heinrich Mann, Brecht, and Böll. (Alternate academic years)

111–12 **Comparative Studies in Germanic Literatures—in English** (3–3) Thoenelt
Topics for 1983–84: Ger 111—The human condition and four Western ways of life: French moralism, German *Bildung*, Marxism, and Existentialism. Selected readings from Montaigne, Goethe, Schiller, Thomas Mann, Marx, Brecht, Nietzsche, Martin Buber, and Camus. Ger 112—Why literature? What is literature? Views and perspectives on the "usefulness" and "uselessness" of literature in modern Western societies. From Plato to the 20th century. Selected works and excerpts from Plato, Aristotle, Horace, Shakespeare, Montaigne, Goethe, Schiller, Heine, Nietzsche, Thomas Mann, Sartre, Camus, Böll and others. (Alternate academic years)

126 **France and Germany—in English** (3) Thoenelt
Comparative study of two European ways of life as reflected and perpetuated by literature and philosophy. Relevant excerpts and documents from the 16th to the 20th century. (Summer)

131–32 **18th-Century German Literature—in German** (3–3) Thoenelt
Enlightenment, Storm and Stress, Classicism. Reading, lecture, and discussion. Central topic: *Geist und Tat*—or the 18th-century con-

* With permission of instructor, Ger 9 or 10 may be taken concurrently with Ger 4.

cept of literature's formative function in society. (Alternate academic years)

141–42 **19th-Century German Literature—in German** (3–3) Steiner
Romanticism, Biedermeier, young Germany, poetic realism. Second age of chivalry and *Sehnsucht*, revolution and counter-revolution in thought and literature. Birth and growth of modern nationalism and cosmopolitanism as reflected in the literature of the period. Reading, lecture and discussion. (Alternate academic years)

151–52 **20th-Century German Literature—in German** (3–3) Steiner
The age of Nietzsche, Naturalism, Impressionism, Expressionism; Kafka, Thomas Mann, Hesse; émigré literature, contemporary drama; authors of Gruppe 47. Reading, lecture, and discussion. (Alternate academic years)

161–62 **Studies in Germanic Languages and Literatures—in English/German** (3–3) King
Topics for 1982–83: Germanic myths and their relationships to the Indo-European genre; their use by Richard Wagner. Topics for 1983–84: History of the German language; German as a West Germanic and an Indo-European language.

179–80 **Advanced German Conversation and Composition** (3–3) Thoenelt
Discussions and compositions on literary and cultural topics, readings of newspaper articles, interpretations of selected texts (Gottfried Benn and Thomas Mann), grammar and style studies. (Alternate academic years)

SANSKRIT

105–6 **First-year Sanskrit** (3–3) King
A year course: credit toward a degree at this University given on completion of Ger 106. Language, literature, and culture of ancient India. Essentials of grammar; reading of classical texts. Aural-oral practice in language laboratory. Laboratory fee, $17.50 per semester. (Alternate academic years)

107–8 **Second-year Sanskrit** (3–3) King
A year course: credit toward a degree at this University given on completion of Ger 108. Language, literature, and culture of ancient India. Continuation and review of grammar; reading of more difficult classical and Vedic texts. Aural-oral practice in language laboratory. Prerequisite: Ger 105–6 or equivalent. Laboratory fee, $17.50 per semester. (Alternate academic years)

GERONTOLOGY—GRADUATE PROGRAM

Professors R.G. Brown *(Academic Director)*, R.A. Kenney
Professorial Lecturer M. Sicker
Associate Professor R.M. Scheffler
Associate Professorial Lecturer M.H. Morrison

Committee on Gerontology
W.G. Boren, R.G. Brown *(Academic Director)*, J.C. Heddesheimer, R.A. Kenney, R.M. Scheffler

The Graduate School of Arts and Sciences offers an interdisciplinary program leading to the degree of Master of Arts in Special Studies with a concentration in gerontology, directed by the Committee on Gerontology and

drawing upon faculty from various departments within the University and resource persons in the community.

The Gerontology Program derives its theoretical perspectives and substantive knowledge from several disciplines to provide a balanced study of the processes of aging, and societal reactions and responses to the aged and their problems, with the objective of preparing persons for positions which involve the planning, development, and evaluation of programs serving older persons. Each student will work closely with an advisor to design a program of studies appropriate to individual interests and professional objectives. Every student will have field experience in an agency involved in the planning and evaluation of services for the elderly. Prospective candidates should consult with the director of the Gerontology Program.

Master of Arts in Special Studies with a concentration in gerontology—Prerequisite: a bachelor's degree with a *B* average (or equivalent) from an accredited college or university. In some cases, the applicant may be requested to take the Graduate Record Examination. Previous experience in gerontology is not essential; a variety of academic and experiential backgrounds are acceptable.

Required: the general requirements, pages 89–96, including 36 semester hours of course work. There is no thesis requirement. At least 18 hours must be taken in arts and sciences departments. Gern 201, 205, 290; Soc 280, 254; Educ 344; and HSA 290 are core courses required for all students. The remaining five courses must be taken in no more than two fields. In addition, the program involves a tool requirement, which may be satisfied by obtaining the grade of *B* or better in Stat 53 or by passing a waiver examination. The tool requirement must be fulfilled before the final two core courses are undertaken. All students are required to pass a Master's Comprehensive Examination.

201 **The Biology of Aging** (3) Kenney
The processes of aging in the various systems of the human body; principal illness patterns in the elderly; theories of the aging process. (Spring)

205 **Public Policy and Aging** (3) Scheffler, Sicker
The "political economy" of aging in our society. Political and governmental processes as they influence and are influenced by older persons; the impact of demographic trends and retirement patterns on the economic system. (Fall)

290 **Practicum in Gerontology** (3) Morrison
Field experience in an agency involved in the planning and evaluation of services for the elderly.

GREEK

See **Classics.**

HEALTH SERVICES ADMINISTRATION

Professors L. Gintzig, M.C. Devolites *(Emeritus)*, K.J. Darr, P.N. Reeves *(Chairman)*, P.S. Birnbaum, R.G. Shouldice
Professorial Lecturers H.L. Hirsh, C.C. Rorrie, H.R. Wertlieb
Associate Professors R.F. Southby, L.G. Pawlson, S.D. Lind
Adjunct Associate Professors J.L. Ryan, J.C. Wilmot
Associate Professorial Lecturers C.V. Gordon, N.B. Hadley, A. Liberman, A.J. Singh

Assistant Professors G.E. Crum, C.P. McKelvey, M.E. Hatcher *(Visiting)*, W.D. Greaf *(Research)*, D.J. Moon *(Research)*
Assistant Professorial Lecturers M.G. Bromley, M.M. Barch, D.P. Andrulis, S.B. Cohen, M.E. Samuels, D.F. Eversmann, P.L. Knight
Lecturers J.E. Clair, R.E. Koran

Programs of study leading to the degrees of Master of Health Services Administration* and Post-Masters Graduate Certificate in Health Services Administration, and areas of concentration in health services administration in programs leading to the degrees of Doctor of Business Administration and Doctor of Public Administration, are offered by the School of Government and Business Administration (see pages 131–62).

Second Group

142 **Financial Management in Health Care Institutions** (3) Eversmann
Consideration of the nature, analysis and interpretation of accounting data. Cost accounting, budgeting and internal control techniques, emphasis on their use in the management planning and control process. (Spring)

153 **Survey of Health Care Organization** (3) Clair
Introduction to the organization and delivery of health care services in the U.S. Emphasis on the structural features of and the resources available to the health care system. (Fall)

154 **Introduction to Hospital Management and Procedures** (3) Clair
Introduction to the structure and management of contemporary American hospitals; emphasis on the organization of hospital departments and on the functions of the department manager. Prerequisite: HSA 153 or consent of instructor. (Spring)

170 **Quantitative Methods in Health Care Administration** (3) Gordon
Application of quantitative methods to the health services industry. Fundamental statistical techniques enabling the student to read, comprehend, critically appraise and intelligently utilize the growing volume of quantitative research appearing in the health services literature. Familiarization with quantitative procedures applied to analyzing management problems in the operational environment. Emphasis on establishing a fundamental understanding of statistical ideas rather than upon manipulating predeveloped formulas. (Fall)

190 **Special Topics in Health Care Administration** (3)
Experimental offering at the undergraduate level. (Fall and spring)

Third Group

202 **Introduction to Health and Medical Care** (3) McKelvey, Crum, Samuels
Lecture and discussion (2 hours), laboratory (2 hours). Examination of the nature of health and disease using biomedical, epidemiological, and ecological models. Description and analysis of resource, process, and control components involved in delivering services—technology, manpower, patients, delivery mechanisms, and assessment and allocative mechanisms. Survey of selected disease problems and their impact on management and planning. Medical terminology. (Fall and spring)

203 **Organization and Management of Health Services** (3) Shouldice, Hadley, Gintzig
Application of management theory and concepts to health services

* Accredited by the Accrediting Commission on Education for Health Services Administration.

systems and institutions. Characteristics, functions, and organizational structures of delivery systems. (Fall and spring)

207 **Program Evaluation in Health Services** (3) Lind, Liberman, Hatcher
Basic investigatory techniques used to conduct, as well as to assess and interpret, evaluation of health services programs. Includes information systems and data collection, analyses, and reporting. Introduction to computer applications. (Fall and spring)

208 **Quantitative Methods in Health Services Operations** (3) Hatcher, Cohen
Concepts and application of quantitative methods in health services operations, involving biostatistics, demand analysis and forecasting, resource allocation, and quality and productivity control. (Fall and spring)

209 **Health Resources Management I** (3) Devolites, Birnbaum, Koran
Introduction to health resource management and funds administration for health services institutions and agencies. Preparation of budgets, financial statements, and reports. Financial analysis. Management of plant and equipment. Regulation and containment of costs. Safeguarding assets. (Fall and spring)

210 **Health Resources Management II** (3) Southby, Hatcher
Study of health manpower, development, allocation, and utilization. National health expenditures. Review of micro- and macroeconomic principles as they apply to health services programs. (Fall and spring)

212 **Introduction to Health Services Planning** (3) Hatcher, Rorrie, Crum
History and development of health services planning in the United States. The generic planning process and basic health services planning methods and procedures useful in project planning. Introduction to strategic planning and marketing concepts relevant to health services planning (e.g., service area determination). (Fall and spring)

215 **Health Services and the Law** (3) Hirsh
The sources of law and the legal processes affecting the health services system. Elements of administrative law and agency processes. Introduction to the legal relationships, e.g., torts, contracts, and insurance, of facilities, physicians, personnel, and patients. Legal aspects of labor relations, and trends in health services delivery law. (Fall and spring)

221 **Health Systems Strategic Planning** (3) Reeves, Singh
Applications of advanced quantitative and analytic methodologies in planning health services systems (e.g., priority determination, health status indicators and indexes, models, interaction analyses). Focus on a sequence of critical components of the strategic planning process for both institutional and community systems. (Fall)

223 **Policy in Strategic Health Services Planning** (3) Crum
Effects of legal, political, social, and economic factors in strategic health planning. Emphasis on formulation, analysis, and implementation of local and institutional health policies. The role of these policies as expressions of values which serve as guiding forces in the strategic planning process. (Spring)

225 **Developing National Health Services Policy** (3) Darr
Understanding and analyzing the processes by which health services policy is formulated and implemented at the federal level. Focus on Congress, the presidency, and the agencies. (Fall)

227 **Seminar: Ethics in Health Services Administration** (3) Darr, Crum
Investigating moral and ethical problems confronting the health services system. Understanding the legal, social, and policy implications of issues in medical and health services delivery such as: administrative and institutional ethics, professional codes, impaired professionals, death, fertility control, experimentation and new technology, and resource allocation. (Spring)

231 **Managing the Short-Term Hospital** (3) Darr, Barch
Lecture and discussion (2 hours), laboratory (2 hours). Organization, management, and interrelationships of hospital clinical, support, and administrative departments. Analyses of procedures and systems. Hospital personnel administration. Administrative ethics. Requirements of the Joint Commission on Accreditation of Hospitals. Prerequisite: HSA 203 and Mgt 207, or permission of instructor. (Fall and spring)

233 **Delivery of Mental Health Services** (3) Andrulis
Study of the organizations and systems for delivery of mental health services; emphasis on management and financing treatment and rehabilitation facilities. (Fall and spring)

235 **Human Services Integration** (3) Reeves
Introduction to the concept of a human services system. Description and analysis of current human services programs as components of such a system and of the roles of the public and private sectors in providing these services. Discussion of interorganizational theory as a basis for understanding current system configurations and for developing improved service delivery systems. (Spring)

236 **Introduction to Long-Term Care Administration** (3) Lind, Wertlieb, Moon
Evolution of long-term care as a health care delivery subsystem. Comparative evaluation of characteristics of various types of institutions and programs. Government regulation. Relationships between the purposes and functions of these institutions and programs and the health care needs of the community are investigated. (Fall)

237 **Managing the Long-Term Care Institution** (3) Wertlieb
Organization and management of nursing homes, personal and residential care facilities, and institutions for other populations needing long-term specialty treatment. Emphasis on personal and professional skills necessary to provide a wide range of services and quality care in these environments. (Fall and spring)

238 **Ambulatory Health Services Management** (3) Shouldice
Introduction to the organization and management of ambulatory care. Presentation of models, financing mechanisms, institutional affiliations, estimating and planning for ambulatory care, and the use of solo and group practice of medicine as part of a total system of services delivery. (Fall)

239 **Management of Health Maintenance Organizations** (3) Shouldice, Ott
Basic principles and fundamentals of prepaid group practice and health maintenance organizations. Emphasis on planning, development, and operation of HMOs, including discussion of models, financial issues, consumers, and providers of care. (Spring)

245 **Case Studies in Health Services Administration** (3) Devolites, Birnbaum, Southby
Intensive qualitative and quantitative analyses of major problem areas in health system management and planning using the case

study method. Cases cover the broad spectrum of health policy, planning, and operations of the health services system. Serves as a capstone course for health services management students. (Fall and spring)

252 **Comparative Health Services Systems** (3) Gintzig
Evaluations of various organizational patterns, functions, and trends in international health services delivery systems. Emphasis on sources of such differences and significance of the systems to the health status of a nation. Primarily for advanced students, open to others by arrangement. (Spring)

255 **Issues in Gerontology** (3) Lind
Interdisciplinary seminar on the nature and problems of aging, including social, psychological, biological, economic, demographic, health, and service needs of the older population. Introduces theory and research, and explores attitudinal and behavioral components based on contact with older persons. Discussion of reactions to aging. (Fall)

257 **Advanced Health Resources Management** (3) Bromley
Development of financial health policies, objectives, and programs. Financial management of multi-unit health care systems; financial aspects of national health programs, prospective rates, and regulation of health prices; case studies and field research. (Fall and spring)

270 **Research in Health Services Administration** (3) Reeves
Field research. Primarily for advanced students; open to others with consent of instructor. May be repeated for credit. (Fall and spring)

271 **Field Problem Studies in Health Services Administration** (3) Crum
Work experience guided by a qualified preceptor on selected management and planning issues and problems occurring in health services facilities, programs, and agencies. Primarily for advanced master's and doctoral students; open to other students by arrangement. May be repeated for credit. (Fall and spring)

273–74–75 **Residency I** (3–3–3) Staff
Twelve-month residency. Work experience guided by a qualified preceptor; periodic written progress reports and a written major report or selected field projects are required. (Fall and spring)

276–77–78 **Residency II** (3–3–3) Staff
For students who take additional residency experience. (Fall or spring)

285–86 **Readings in Health Services Administration** (3–3) Reeves and Staff
Supervised readings in special areas of health services management and in policy and planning. Primarily for advanced students; open to others by arrangement. May be repeated for credit. (Fall and spring)

290 **Special Topics in Health Services Administration** (3) Staff
Experimental offering; new course topics and teaching methods. May be repeated for credit. (Fall or spring)

299–300 **Thesis Research** (3–3) Staff
(Fall and spring)

Fourth Group

Fourth-group courses are primarily for doctoral students, and are offered as the demand requires. They are open to the other graduate students at the discretion of the Department.

310 **Health Resources Allocation Policies** (3) Southby
Study of major contemporary issues in health resources allocations. Development and critique of policies designed to deal with these issues. (Fall)

311–12 **Seminar: Public-Private Sector Institutions and Relationships** (3–3) Staff
An analysis and critique of alternative theoretical frameworks for describing, understanding, and predicting the nature, values, and actions of American public and private institutions. Problems, potentials, and alternatives for structuring public and private institutional arrangements to meet the needs of society.

330 **Health Services Delivery Policy** (3) Lind
Study of major contemporary issues in health services delivery. Development and critique of policies designed to deal with those issues. (Spring)

398 **Advanced Reading and Research** (arr.) Staff
Limited to doctoral students preparing for the general examinations. May be repeated for credit. (Fall and spring)

399 **Dissertation Research** (arr.) Staff
Limited to doctoral candidates. May be repeated for credit. (Fall and spring)

HEBREW

See Classics.

HISTORY

Professors R.H. Davison, R.C. Haskett, R.P. Sharkey, H.M. Sachar, R.W. Kenny, P.P. Hill, L.G. DePauw, R. Thornton, L.G. Schwoerer, P.F. Klarén, R.E. Kennedy, Jr.
Adjunct Professor R.P. Multhauf
Professorial Lecturers S. Shaloff, A.B. Davis, D.C. Allard
Associate Professors C.J. Herber, W.R. Johnson *(Chairman)*, R.A. Hadley, A.D. Andrews, J.O. Horton, L.P. Ribuffo, W.H. Becker *(Visiting)*, L.W. Banner *(Visiting)*
Adjunct Associate Professors L.J. Lear, A.L.K. Nelson
Assistant Professor M.A. Atkin

Bachelor of Arts with a major in history *(field-of-study or departmental)*—The following requirements must be fulfilled:

1. The general requirements as stated on pages 71–72, 79–85. (Students should consult the departmental advisor regarding courses to be taken in satisfying the requirement for meaningful initiation into the humanities and the natural and mathematical sciences.)
2. Required introductory courses—Hist 39–40, 71–72, or equivalent. Majors may waive one or more of the prerequisite courses by passing departmental examinations, by attaining scores of 600 or above on the College Entrance Examination Board Achievement Tests, or by good performance on Advanced Placement Examinations. Credit for one or more of the prerequisite courses may be received by superior performance on departmental or Advanced Placement Tests. The Department does not accord either waiver or credit by CLEP examination.
3. Required courses in related areas—(a) either 12 semester hours of an approved foreign language or (b) nine semester hours in statistics (Stat 53, 105, and 87).

4. (a) *Field-of-study major*—Hist 199 (Proseminar), six semester hours of third-group courses, including at least three semester hours of research seminar, and the passing of the major examination in the senior year. In planning a program, the student, under the guidance of an advisor, should choose courses which will provide a broad understanding of diverse chronological and geographical aspects of the human experience.

(b) *Departmental major*—27 or more hours of second- and third-group courses, including Hist 199, six semester hours of third-group courses, including at least one research seminar, and six semester hours chosen from each of the following fields: I (Europe)—Hist 101, 105, 106, 109, 110, 111, 112, 113–14, 121, 122, 123, 124, 125, 127, 128, 129, 131, 132, 136, 139, 140, 141, 142, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 198; II (United States)—Hist 113–14, 128, 129, 133, 134, 137, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 179, 180, 181, 182, 183, 184, 185, 186, 197, 198; III (Russia, Asia, Africa and Latin America)—Hist 102, 107, 108, 116, 119, 135, 143, 145, 146, 158, 161, 162, 163, 164, 165, 166, 187, 188, 189, 193, 194, 195, 196.

Courses numbered 198 and courses in the 700 Series may also satisfy one of the three Field requirements. Departmental majors should inquire of the department chairman or major advisor as to the specific applicability of these courses.

A pamphlet relating to the major is available in the offices of the dean of the Columbian College of Arts and Sciences and in the History Department.

An Honors Program may be chosen by juniors with satisfactory scholastic records. Application to this program must be made before the beginning of the second semester of the junior year. Students accepted into the program take a three-hour seminar in the second semester of the junior year and complete the research requirements for the history major by preparing the Senior Honors Thesis (Hist 191–92) in the final year of undergraduate study.

Minor in history—Undergraduate students who select a minor in history must ordinarily declare their intention to the departmental advisor no later than the beginning of their senior year. Such students may choose a non-specialized history curriculum, or may concentrate in one area such as ancient history, medieval history, early modern Europe, modern Europe, the Near East, Russia and East Europe, the United States, Latin America, or the Far East, or in one field such as economic, social, intellectual, diplomatic, political, black, or women's history. In each case the program of courses will be planned in consultation with the history advisor. To meet the departmental requirements for a minor, the student must complete at least 15 semester hours in approved courses with a grade of C or above. One 3-semester-hour seminar must be included in the program.

Master of Arts in the field of history—Prerequisite: a bachelor's degree from an accredited college or university with a major in history, or an equivalent degree; high scholastic standing; and approval of the department. Applicants from other institutions must present scores on the Graduate Record Examination with the Advanced Test in History and arrange for four persons, preferably former instructors, to send letters or reference forms to the Office of the Graduate School of Arts and Sciences.

Required: the general requirements, pages 89–96. The program of study consists of (1) a minimum of 30 semester hours of second- and third-group courses, including Hist 299–300 *Thesis Research*, or (2) a minimum of 36 semester hours of second- and third-group courses, including at least two research seminars (six semester hours). Hist 201 is required of candidates who have not previously had a course in historiography and historical method. At least six semester hours of each candidate's program must be in third- or fourth-group history courses; a maximum of six may be in approved courses

outside the History Department. To receive graduate credit for second-group courses, master's candidates must arrange for extra work with the instructors. Each student works in two fields of history and is required to pass a Comprehensive Examination in each.

Master of Arts in the field of history with a concentration in historic preservation—Required: the general requirements, pages 89–96. This 36-hour master's degree program combines courses in United States history and historic preservation. It includes at least 18 hours of U.S. social history, U.S. urban history, man-made America, and the seminar sequence in historic preservation. For other course distribution requirements, see the departmental graduate advisor. Candidates in this program may satisfy the tool requirement by passing an examination in measured architectural drawing.

Doctor of Philosophy in the field of history—Required: the general requirements, pages 89–91, 96–99, including the passing of a written examination in two appropriate foreign languages, or one foreign language and an approved tool subject, and the satisfactory completion of the General Examination in four fields. Normally, each doctoral candidate will work in one major (or general) field of study and three special fields. The major fields include the following: ancient history, medieval Europe, early modern Europe, modern Europe, United States, Latin America, modern Near East, modern Far East, Russia and East Europe. Special fields may vary from the topical (e.g., U.S. social history, European intellectual history, historic preservation, etc.) to the chronologically limited fields (e.g., American colonial history, Tudor and Stuart England, etc.). A student may elect one special field outside of the History Department if it is relevant to the program. Students having a special field in historic preservation may satisfy one tool requirement by passing an examination in measured architectural drawing.

Bachelor of Arts in Education and Human Development with a teaching field in history—Prerequisite: the education curriculum, pages 111–12.
Required: the history option and the professional courses on page 115.

Course Accessibility: All second-group courses are open to students without history course prerequisites with the exception of Hist 157 and 199.

First Group

39–40 European Civilization in Its World Context (3–3) **Staff**
Hist 39: Introduction to the political, social, economic, religious, and cultural history of Europe from about 800 A.D. to 1715. Hist 40: from 1715 to the present. (Academic year)

41 Roots of the Western Tradition (3) **Staff**
Same as Clas/Engl/Phil/Rel 41. Basic ideas of Western thought from early Greek, Roman, Judaic, and Christian traditions. Representative readings in drama, epic, historical writings, oratory, creation stories, scriptural traditions, philosophy, and spiritual autobiography. To be taken only in conjunction with Engl 13. (Spring)

71–72 Introduction to American History (3–3) **Staff**
Hist 71: political, social, economic, and cultural forces of the United States, in world perspective, from the earliest settlements to 1876. Hist 72: from 1876 to present. (Academic year)

***91 East Asia—Past and Present** (3) Johnson and Associated Faculty
An interdisciplinary course, introducing the student to a comprehen-

* An interdepartmental course offered by the History, East Asian Languages and Literatures, Economics, Geography and Regional Science, Philosophy, Political Science, and Religion Departments.

sive and integrated understanding of the civilization and present problems of East Asia.

Second Group

101 **The European Revolutionary Tradition, 1640-1917** (3) Kennedy
(Formerly History of Revolution)
A comparative study of the English, French, and Russian revolutions with focus on theories of revolution, revolutionary ideology, millenarianism, and the revolutionary legacy inherited by third-world movements. (Fall)

105–6 **History of Science** (3–3) Multhauf
Hist 105: from ancient natural philosophy through the 17th-century scientific revolution. Hist 106: from the Industrial Revolution to the 20th-century amalgamation of science and technology. (Academic year)

107 **The Ancient Near East and Egypt to 322 B.C.** (3) Hadley
Survey of Egyptian, Mesopotamian, Anatolian, West Semitic, and Iranian civilizations from the Neolithic period to Alexander's conquest.

108 **Greece and the Near East, 359 B.C. to the Second Century A.D.** (3) Hadley
Survey of cultural, social, political, and economic developments in the Hellenistic world and societies of the Near East from the reign of Philip II to the height of Roman power and influence in these regions.

109 **Early Aegean and Greek Civilizations to 338 B.C.** (3) Hadley
Neolithic background: Bronze age—Minoan, Helladic, and Mycenaean civilizations; classical Greek civilization to the Macedonian conquest (Fall)

110 **The Roman World to 337 A.D.** (3) Hadley
Prehistoric Italy; rise and decline of the Roman Empire and Latin civilization; cultural, social, and political developments in the Greek world under Roman rule. (Spring)

111–12 **Medieval History** (3–3) Andrews
Hist 111: Failure of the old Roman Empire, formation of barbarian kingdoms in the West and their evolution to about 1000 A.D.; Byzantium and Islam at their apogee. Hist 112: Medieval European daily life, institutions, and creative movements to about 1400; the Crusades and the Near East to the rise of the Ottoman Turks. (Academic year)

116 **History of Africa** (3) Shaloff
Survey of political, cultural, and economic development from ancient times to the present. (Spring)

117 **Crisis or Conspiracy? A History of the International Politics of Oil** (3) Becker
The history of the international politics of oil, with special attention to developing relationships between major oil companies and governments here and abroad. (Summer)

118 **Business and American Life** (3) Becker
The historical interaction of business with other American institutions: religion, the family, law, education, government, labor unions, etc. (Summer)

119 **China in the 20th Century: Reform and Revolution** (3) Johnson
Origins, goals, substance, and significance of political, social, and intellectual upheavals in China from 1900 to the present. (Summer)

120 The Medieval Near East (3) Andrews
Byzantium and the Islamic World. The Crusades and their consequences. The Mongols, Ottoman Turks, and their neighbors of the 17th century: Eastern and Western perspectives. (Spring)

121 The Renaissance in Western Europe (3) Schwoerer
Study of the economic, political, intellectual, and cultural acceleration in Western Europe, beginning in the Italian city-states and spreading to France, Germany, and England, in the 14th through 16th centuries. (Fall)

122 The Reformation in Western Europe (3) Herber
Religious, political, and social consequences of the theological upheavals of the 16th century. (Spring)

123 European Intellectual History I (3) Kennedy
Popular culture; religion and science in the 17th century; the Enlightenment; Voltaire, Hume, Rousseau, Montesquieu, Beccaria, Diderot, Condorcet on religion, history, nature, society, and politics; the intellectual origins of the French Revolution. (Fall, EVEN years)

124 European Intellectual History II (3) Kennedy
Intellectual responses to the French Revolution; 19th-century historical approaches to society, religion, economics, biology, ethics, and psycholanalysis: Hegel, Comte, Marx, Darwin, Nietzsche, and Freud; the intellectual origins of Nazism; literary, artistic, and philosophical responses to World War I. (Spring, odd years)

125 Women in European History (3) Schwoerer
A study of the role of women in the political, social, intellectual, and economic life of Europe from the Middle Ages to the 20th century. (Spring)

127 Theories of History (3) Lavine
Same as Phil 127.

128–29 War and Society (3–3) McDonald
How wars, armed forces, and defense policies have affected British and American politics and society. Special attention to the relationship of defense and foreign policy, civil-military relations, the development of strategic thought, and to the naval and military influence Britain and America have exerted on each other. Hist 128: from 1776 to 1918. Hist 129: 1919 to the present. (Academic year)

131–32 History of Germany (3–3) Herber
Political, social, and cultural development. Hist 131: from mid-17th century to Bismarck. Hist 132: from William II to the present. (Academic year)

133 Recent U.S. History, 1890-1941 (3) Ribuffo
Political, social, diplomatic, and intellectual developments, with particular emphasis on the "searching" 20's and New Deal. (Fall)

134 Contemporary U.S. History Since 1941 (3) Ribuffo
Political, social, diplomatic, and intellectual developments, with particular emphasis on the Cold War, "silent" 50's, and disrupted 60's. (Spring)

135 History of Soviet Intelligence Services (3) Dziak
The role and impact of intelligence and security operations in Soviet domestic and foreign policy, 1917 to the present. The course examines the literature and problems of Soviet intelligence operations; Tsarist antecedents; Lenin, the Cheka, and the formative years; operations under Stalin; problems of the post-Stalin years; and operations in the Brezhnev era.

136 **Europe in the 20th Century** (3) Sachar
Diplomatic, political, and cultural developments from the turn of the century to the present. (Summer)

137 **U.S.-Soviet Strategic Relations Since World War II** (3) Thornton
Survey of U.S.-Soviet global rivalry from World War II to the present; comparative historical assessment of the changing strategic balance. (Spring)

139–40 **World History in the 20th Century** (3–3) Sachar
Diplomatic, political, and cultural factors. Hist 139: from the turn of the century to the Munich settlement of 1938. Hist 140: from the Munich settlement to the present. (Academic year)

141 **History of France I** (3) Kennedy
Old Regime: Louis XIV, demography, peasants, bourgeois, nobles; Church-Protestant-Jewish relations; salons, Enlightenment and *philosophes*; literacy and education; Robespierre and Revolution; Napoleon. (Fall, odd years)

142 **History of France II** (3) Kennedy
The Revolutionary tradition, and authoritarianism from the Restoration to De Gaulle; the events of 1848, socialism and the class struggle; women, marriage, morals, and population; industrialization and rural France; dechristianization, Catholic integralism and worker priests; France's decline as a world power; its intellectual and artistic leadership. (Spring, even years)

145 **Russia to 1801** (3) Atkin
Survey of Russian history from the rise of the Kievan confederation in the ninth century to the establishment of Imperial Russia as a European great power. Attention will be given to the political, socio-economic, and cultural history of the East Slavs, especially the Russians. (Fall)

146 **Russia and the Soviet Union from 1801 to the Contemporary Era** (3) Atkin
Survey of Russian and Soviet history from the reign of Alexander I to the post-Stalin era. Attention will be given to the contending forces of revolution, reform, and conservatism; diplomatic relations; economic development; social change; and Russian culture. (Spring)

147 **Economic History of Modern Europe** (3) Sharkey
Joint offering of the History and Economics Departments. Economic development since the Middle Ages; emphasis on the period following the Industrial Revolution. Evolution of capitalism and its impact upon the societies of Europe. (Spring)

148 **The French Revolution** (3) Kennedy
Social, political, economic, and cultural history of the decade of revolution, 1789–1799. Attention to its structural consequences in France and in Europe-at-large. (Summer)

149–50 **European Diplomatic History** (3–3) Davison
Emphasis on policies and actions of the great powers and their statesmen. Issues of war and peace, international crises, nationalism, alliances, and tensions. Hist 149: 1812 to 1890. Hist 150: since 1890. Students who receive credit for Hist 150 cannot receive credit for Hist 157. (Academic year)

151–52 **History of England** (3–3) Kenny
Development of English civilization and its impact on Western culture. Hist 151: to 1689. Hist 152: since 1689. (Academic year)

153 **Tudor England** (3) Kenny
Aspects of the constitutional, social, intellectual, economic, and religious development of England, 1485-1603. (Fall)

154 **Stuart England** (3) Schwoerer
Grand Rebellion, Restoration, and Glorious Revolution. The political, religious, socioeconomic, and intellectual developments in England, 1603–1714. (Spring)

155 **History of Modern Ireland** (3) Kenny
The political and cultural development of Ireland since the Middle Ages and the continuing interaction between Ireland and England, with emphasis on the period from the Act of Union of 1801 to the Partition of 1923.

156 **Winston Churchill as War Leader** (3) McDonald
Churchill's role—from cavalry subaltern to prime minister—in the British Empire's wars during his lifetime, with special attention to the two world wars.

157 **20th-Century European Diplomatic History** (3) Sachar
The main currents, with necessary 19th-century background. Students who receive credit for Hist 157 cannot receive credit for Hist 150. (Fall)

158 **Modern Jewish History** (3) Sachar
A secular history of the Jewish people from the 18th century to the present state of Israel; emphasis on European political, economic, and cultural influences. (Spring)

161 **Revolution in 20th-Century Latin America** (3) Klarén
Examination of the major social revolutions in modern Latin America, especially in Mexico (1910), Bolivia (1952), Cuba (1959), and Chile (1970); their origins, social composition, leadership, and ideology. (Spring, even years)

162 **20th-Century Latin America** (3) Klarén
A survey of the main societal trends shaping Latin America in this century, with particular emphasis on such themes as populism, urbanization, reformism, modernization, Peronism, nationalism, Communism, Castroism, the military, and the development process. (Spring)

163–64 **History of Latin America** (3–3) Klarén
Hist 163: Analysis of Spanish and Portuguese imperialism in the New World, 1492-1820. Hist 164: a problems approach to Latin America, 1820 to the present; thematic emphasis on neo-colonialism, corporatism, liberalism, *caudillismo*, modernization, populism, and revolution. (Academic year)

165 **Latin America and the Industrializing World, 1850–present** (3) Klarén
Examination of the political/diplomatic responses of Latin American nations, individually and collectively, to the expanding industrial powers of the Northern hemisphere in the 19th and 20th centuries. (Fall)

166 **History of Mexico** (3) Klarén
Focus on Aztec imperialism, the Indian view of the Conquest, landlord/peasant relations, the struggle for independence, the Revolution of 1910; race, caste and class in modern Mexico; the role of the modern Mexican state. (Fall, odd years)

167 **Man-Made America: The Old Colonial Scene** (3) Haskett
An interpretive tour through the early American landscape, 1607–1750. Heavily illustrated with color slides. (Fall)

168 Man-Made America: Views of a New Nation (3) Haskett
An interpretive tour through the early American landscape, 1750–1820. Heavily illustrated with color slides. (Spring)

169 The American Revolution (3) DePauw
The political, intellectual, social, military, and economic impact of the events surrounding the separation of the United States from the British Empire. Special attention to the influence of non-elite groups. (Spring)

170 U.S. Early National History (3) Hill
Political, diplomatic, economic, and social history of the early republic, 1789–1828. (Fall)

171–72 U.S. Social History (3–3) Horton
Hist 171: daily life, institutions, intellectual and artistic achievements of the agrarian era, 1607–1861. Hist 172: the urban-industrial era from 1861 to present.

173 Afro-American History (3) Horton
Survey of the Afro-American experience, emphasizing the contributions of black Americans to, and their impact upon, American history. Same as AmCv 173. (Fall)

174 Special Topics in Afro-American History (3) Horton
Concentration on specific issues central to the Afro-American experience. Consult Spring *Schedule of Classes* for issues to be addressed. Same as AmCv 174. (Spring)

175–76 U.S. Political History (3–3) Haskett
A study of power: who gets what, where, when, and how. Hist. 175, 1763–1865; Hist. 176, 1865–1960. (Academic year)

177 The Ante-bellum South (3) DePauw
Investigation of political, economic, intellectual, social, and cultural characteristics of the American South prior to 1860. Special attention to myths associated with the South, ideologies supporting the slave system, and cultural practices among the white, black, and Indian populations. (Fall, alternate years)

179–80 U.S. Economic History (3–3) Sharkey
Joint offering of the History and Economics Departments. Economic growth from colonial times to the present. Development of various sectors in the economy and their interdependence. Hist 179: 1607–1865. Hist 180: from 1865 to the present. (Academic year)

181–82 U.S. Diplomatic History (3–3) Hill
American foreign relations from the era of the American Revolution. Hist 181: to 1898. Hist 182: 20th century. (Academic year)

184 Civil War and Reconstruction (3) Horton
How the Union and Confederacy organized for war, evolved strategies, and searched for commanders who could win battles and how the war affected ordinary soldiers and citizens. Political, economic, and social consequences of the Civil War. (Spring)

185 History of Women in America (3) DePauw
Survey of the political, economic, social, military, religious, intellectual, and cultural practices in North America from 1000 A.D. to the present as these have affected and been affected by the female half of the population. Same as AmCv 185. (Fall)

186 U.S. Urban History (3) Gillette
The American city from colonial foundations to the present, relating social and economic forces to physical form. Special emphasis on transitions from pre-industrial to industrial to metropolitan forms.

focusing on implications for public policy and historic preservation. Same as AmCv 186. (Fall)

187 **History of Modern China** (3) Johnson
China since 1840, particular attention to political developments. (Fall)

188 **History of Chinese Communism** (3) Thornton
Survey of the leadership, ideology, structure, and foreign and domestic policies of the Chinese Communist Party from its inception to the present. (Fall)

189 **History of Modern Japan** (3) Sigur
Japan's century of modernization—from the Meiji Restoration of 1868 to the present. Emphasis on historical, political, economic, and cultural factors. (Fall)

190 **Ethnohistory** (3) Wagner, Humphrey
Same as Anth 190.

191–92 **Senior Honors Thesis** (3–3) Herber
Required of and open only to undergraduate honors candidates in history. (Academic year)

193 **History of the Near East** (3) Davison
Byzantine, Arab, Persian, and Islamic backgrounds; rise and decline of the Ottoman Empire; action of European powers in the area; Ottoman breakup into the Turkish Republic and other states. (Fall, even years)

194 **History of the Modern Near East** (3) Davison, Sachar
Beginning with Napoleon's invasion of Egypt. Development of nationalism and of modern states; impact of the West on culture and institutions; great-power imperialism; crises of Turkish Straits, Suez, Arab-Israeli relations; and other issues. (Fall, odd years)

195 **Traditional Civilizations of China and Japan** (3) Johnson
Intellectual, institutional, and social development of the traditional civilizations of China and Japan from their origins to 1800. (Fall)

196 **The Modern Transformation of China and Japan** (3) Johnson
The social, political, and intellectual transformation of China and Japan from the mid-19th century to the present. (Spring)

197 **Oral History and Interview Techniques** (3) Staff
Same as AmCv 197.

198 **Special Topics in History** (3) Staff
Historical perspectives on great issues of past and present. New topic each semester.

199 **Proseminar: Readings for the History Major** (3) Staff
Required of senior history majors. Readings and discussions on major trends in history; representative selections from the classics of historical literature. Students who receive credit for Hist 199 cannot receive credit for Hist 201. (Fall and spring)

Third Group

Any student who has had the appropriate preparation may, with the consent of the instructor, enroll in a third-group course. Enrollment is not restricted to history majors and graduate students. History majors will satisfy the third-group requirement by taking either two courses for research or one course for research and one course for a readings program.

201 **History and Historians** (3) Staff
Historiography and historical method for graduate students. Readings and discussions on major trends in history; selections from

classics of historical literature. Students who receive credit for Hist 201 cannot receive credit for Hist 199. (Spring)

203–4 **Seminar: Research or Readings** (3–3) Staff
Offered on demand for individual research programs. Prerequisite: approval of department. (Academic year)

205 **Readings Seminar: Evolution of Nationalism in Eastern Europe** (3) Petrov
Formation of national consciousness and emergence of modern East European states after World War I. Developments of the interwar period. Open to qualified undergraduate seniors. (Fall)

206 **Readings Seminar: Revolution in Eastern Europe** (3) Petrov
Transformations of East European states during World War II. Resistance movements, communization, and national self-assertion in the immediate post-Stalin period. Open to qualified undergraduate seniors. (Spring)

209 **Readings/Research Seminar: Topics in Ancient History** (3) Hadley
Readings on general topics in the history of the ancient Near East, Greece, or Rome. Topics to be announced in the *Schedule of Classes*. Students with working knowledge of the appropriate language(s) may receive research credit.

211 **Readings/Research Seminar: Medieval History** (3) Andrews
Prerequisite: Hist 111–12 or equivalent. Students with working knowledge of Latin may receive research credit. Focus on a particular area and period, with emphasis on interdisciplinary research techniques.

213–14 **History in Public Policy-Making** (3–3) Nelson
Seminar in the use of historical insights and methods in policy-making, with emphasis on domestic issues. Assessment and use of primary sources for policy analysis and the use of historical analogy in policy formulation.

215 **Readings Seminar: Communist Monolith That Never Was** (3) Petrov
Soviet relations with East European and Asian socialist states from the end of World War II to the Sino-Soviet split. Changes in substance and form in relations among ruling Communist parties. Open to qualified undergraduate seniors. (Spring and summer)

217 **Readings/Research Seminar: Russian and Soviet Thought** (3) Atkin
Selected topics in the intellectual, social, and cultural history of 19th- and 20th-century Russia and Soviet Union.

220 **American Business History** (3) Becker
A readings or research seminar devoted to the historical development of American business institutions in manufacturing, distribution, transportation, and finance. These business institutions will also be considered in the context of America's legal system, governmental organization, and social institutions. (Fall)

221 **Comparative Business History** (3) Becker
A readings or research seminar on the history of business institutions in manufacturing, distribution, transportation and finance in England, Germany, France, and Japan. The course will be primarily devoted to the period since industrialization, studying business institutions in their economic, legal, governmental, and social contexts. (Spring)

224 **Readings/Research Seminar: European Intellectual History** (3) Kennedy
Cultural history of the French Revolution. Interrelated changes in

political and economic thought, theater, arts, religion, and science from 1789 to 1799. Continuity or discontinuity with pre- and post-revolutionary cultural life.

225 **History of Washington, D.C.** (3) Gillette
Same as AmCv 225.

228–29 **Readings/Research Seminar: Modern Military and Naval History** (3–3) McDonald
Discussion, readings, and research in 20th-century British and American military and naval history. Special attention to World War I (Hist 228) and World War II (Hist 229). Topics include Anglo-American coalition warfare, and the interaction of strategy, diplomacy, and national policy in both war and peace.

230–31 **Readings/Research Seminar: Strategy and Policy** (3–3) McDonald
Hist 230: A study of the historical development of strategy, and the relationship of military thought to national policy. Hist 231: 20th-century strategic thought. (Academic year)

232 **Comparative Communist Systems I** (3) Wolchik
Same as PSc 232.

233 **Comparative Communist Systems II** (3) Wolchik
Same as PSc 233.

234 **Modern Archives Administration** (3) Daniels*
Open to history graduate students and undergraduate majors. Lectures and discussion on all phases of administering archival materials. Classes at National Archives. Students must enroll before September 1 for October session, before April 1 for June session.

237 **Readings Seminar: Soviet Foreign Policy, 1917-1964** (3) Petrov
Concepts and perceptions guiding Soviet relations with the outside world. From the blockade and intervention, through years of isolation, World War II, the Cold War, to "peaceful co-existence" and detente. Open to qualified undergraduate seniors. (Fall and summer)

239 **Readings/Research Seminar: Early Modern European History** (3) Schwoerer
Topics selected from Western European history of the 14th through 17th centuries. Readings or research depending upon students' interests and curricular needs.

241 **Readings/Research Seminar: Modern European History** (3) Herber
Prerequisite: appropriate preparation and consent of instructor.

246 **Readings/Research Seminar: History of Modern Russia and Soviet Union** (3) Atkin
Selected topics in the domestic history of modern Russia and Soviet Union. Readings or research depending upon students' interests and curricular needs. (Fall)

247 **Readings/Research Seminar: The Theory and Practice of Modern Imperialism** (3) Sharkey
Critical analysis of Marxist and non-Marxist theories of modern imperialism in the light of late 19th and 20th century European and American experiences in Asia, Africa, and Latin America. (Fall)

248 **Readings Seminar: Modern European and Near Eastern History** (3) Davison
Admission by permission of instructor. (Spring)

249 **Research Seminar: European Diplomatic History** (3) Davison
Research seminar in individually selected topics concerning the

*Maygene Daniels is Director of the Modern Archives Institute.

foreign policies, actions, and interrelations of the European great powers and their statesmen in the 19th or 20th centuries. Reading knowledge of one language other than English required. (Fall)

251 **Readings/Research Seminar: English People and Institutions** (3) Kenny, Schwoerer
Selected topics in the political, social, intellectual, and economic history of England. Focus upon one time period and special area of interest.

253 **Readings Seminar: History of Sino-Soviet Relations** (3) Thornton
Readings in the history and historiography of Sino-Soviet relations since 1949.

254 **Research Seminar: History of Sino-Soviet Relations** (3) Thornton
Development of analytical and scholarly skills in the study of selected topics. Focus on the preparation of a scholarly paper.

255–56 **Readings/Research Seminar: U.S.-Soviet Strategic Relations Since World War II** (3–3) Thornton
Seminar designed to develop a conceptual framework for understanding contemporary U.S.-Soviet relations. Readings the first semester; research the second. (Academic year)

258 **Communist Party of the Soviet Union** (3) Sodaro
Same as PSc 258.

261 **Readings Seminar: Topics in 20th-Century Latin America** (3) Klarén
Admission by permission of the instructor. (Fall)

262 **Research Seminar: Agrarian Society and Economic Change in Modern Latin America** (3) Klarén
Research on the impact of modernity (e.g., foreign capital, immigration, internal migrations, capitalism, imperialism) on traditional rural society. Admission by permission of instructor. (Spring)

271–72 **U.S. Social History** (3–3) Horton
Hist 271: Readings seminar on American daily life, institutions, and intellectual and artistic achievements. Hist 272: Research seminar.

274 **Research Seminar: Materials in Afro-American Culture** (3) Horton
Joint offering of the History Department and the American Studies Program. Prerequisite: Hist 173 and 174 or equivalent. (Fall and spring)

275–76 **Readings/Research Seminar: U.S. Political and Colonial History** (3–3) Haskett
Research or readings, depending on students' interest and curricular needs. Topics on various aspects of the colonial period or political aspects of various periods. Admission by permission of instructor. (Academic year)

277–78 **Historic Preservation** (3–3) Staff
Same as AmCv/U&RP 277–78.

279 **Readings/Research Seminar: American History** (3) Hill
Readings or research, depending on students' interests and curricular needs. Admission by permission of instructor. (Summer)

281–82 **Readings/Research Seminar: U.S. Diplomatic History** (3–3) Hill
Research or readings, depending on students' interest and curricular needs. Hist 281 covers the period 1776-1890; Hist 282, the period 1890-1950. (Academic year)

283–84 **Readings/Research Seminar: Recent U.S. History** (3–3) Ribuffo
Prerequisite: six semester hours of 100-level American history courses. Research or readings depending on students' interests and curricular needs.

285 **Research Seminar: Women in the United States** (3) DePauw
Prerequisite: Hist 185 or equivalent. Practical examination of research, writing, and publication problems in the preparation of scholarly articles for feminist and historical journals. (Spring—alternate years)

286 **Research Seminar: Early American History** (3) DePauw
Practical skills associated with the production and marketing of historical writing. Each student will write a feature article on an aspect of early American history and edit the work of other members of the class. (Spring—alternate years)

287 **Seminar: Problems in Latin American Civilization** (3) Staff
Same as Anth/Econ/Geog Rom 287, and PSc 285. Interdisciplinary seminar; each student writes a report on some aspect of a selected key theme. May be repeated for credit. Admission by permission of instructor. (Fall and spring)

288 **Research Seminar: History of Chinese Communism** (3) Thornton
Research seminar on selected topics related to China. Emphasis is on developing research methods, concepts, and the preparation of a scholarly paper. (Spring)

289 **Readings/Research Seminar: Modern Japanese History** (3) Sigur
Selected topics in modern Japanese history from the Meiji Restoration of 1868 to the present. Research or readings depending on students' interests and curricular needs. (Spring)

291 **Readings/Research Seminar: 20th-Century History** (3) Sachar
Research or readings on selected topics. (Fall)

292 **Israel, Zionism, and the Arab World** (3) Sachar
Research seminar. (Spring)

293 **Research Seminar: Modern East Asian History** (3) Johnson

294 **Research Seminar: The Modern Near East** (3) Davison
Readings, discussion, and research in selected political, economic, social, cultural, and international developments in the 19th and 20th centuries concerning countries from the Balkans, through Turkey and the Arab countries, to Iran. (Spring)

295–96 **Readings Seminar: Modern East Asian History** (3–3) Johnson

297 **Special Topics Seminar** (3) Staff
Open to doctoral and master's candidates and qualified undergraduates. May be repeated for credit. Offered whenever five or more students can be enrolled.

298 **Dumbarton Oaks Courses** (arr.)
Courses offered each year by scholars in residence at Dumbarton Oaks, Trustees for Harvard University, are open to qualified graduate and undergraduate students with permission of department chairman. Topics will be announced in the *Schedule of Classes*. May be repeated for credit provided the topic differs.

299–300 **Thesis Research** (3–3) Staff
(Fall and spring)

Fourth Group

Prerequisite to all fourth-group history courses: consent of instructor.

Fourth-group history courses are primarily for doctoral students, but master's degree candidates may be admitted.

George Washington University is a member of the Folger Institute of Renaissance and 18th-century Studies. Institute policies are set by a central committee on which each member institution is represented. Doctoral students enrolled in the Institute seminar are eligible to apply for fellowship aid. Folger Institute

Seminars are numbered 301 through 308. Students wishing to register for these courses should consult the chairman of the History Department.

301–8 **Folger Institute Seminars** (3 credits each) Staff
Topics will be announced in the *Schedule of Classes*. May be repeated for credit provided the topic differs.

342 **Readings in Modern European History** (3) Davison
From the French Revolution to the period following World War I. (Spring)

379–80 **Readings in Economic History** (3–3) Sharkey
Joint offering of the History and Economics Departments. Hist 379: American economic history. Hist 380: modern European economic history. (Academic year)

398 **Advanced Readings and Research** (arr.) Staff
Limited to students preparing for the Doctor of Philosophy general examination. May be repeated for credit. (Fall and spring)

399 **Dissertation Research** (arr.) Staff
Limited to Doctor of Philosophy candidates. May be repeated for credit. (Fall and spring)

HUMAN KINETICS AND LEISURE STUDIES

Professors L.M. Stallings, J.L. Breen *(Chairman)*, D. Hawkins, J.E. Snodgrass, D.C. Paup, J.D. Hunt
Adjunct Professor H.D. Bailey
Professorial Lecturers E.L. Shafer, R. Anzola-Betancourt, C.A. Troester, Jr., T. Songster, R.O. Keelor
Associate Professors L.H. George, M.R. Withers, N.D. Johnson
Associate Professorial Lecturers D.L. Edgell, W.M. Kane, D.M. Brody
Assistant Professor H. Nashman
Assistant Professorial Lecturers S.Y. Cha, P.G. Davidoff, D.C. Frechtling, T.J. Riegert, J.V. Ackerman
Instructor A.H. Farbman
Lecturers E.A. Burkhardt, J.J. Goldblatt, L.E. McDevitt, C.D. Cox, M. Elbin, W. Woodson, L. Wilkinson, H. Williams, M.F. Whipp, G.L. Oke, A. Tomalonis, V.C. Huckenpahler, S.L. Cline, D.G. Rivkind, J. Guidone, W.K. Ellis, A.H. Darling, N.B. Smith, M.I. Greenbaum, A.D. Sailer

Programs of study leading to the degrees of *Bachelor of Science in Human Kinetics and Leisure Studies* (opportunity for specialization in elementary and secondary school physical education, dance education, or dance as a performing art) and *Master of Arts in Education and Human Development* (with specialization in adaptive physical education, dance, perceptual-motor development, general physical education, exercise science, therapeutic recreation, and tourism development and travel administration) are offered by the School of Education and Human Development (see pages 101–31).

The University is not responsible for injuries received in any of the activities of the Department of Human Kinetics and Leisure Studies, and the student assumes full responsibility therefor.

First Group

With the exception of students pursuing undergraduate degrees in the School of Education and Human Development, credit for HKLS activities courses is not recognized for the baccalaureate degree. Most first-group courses are offered both in the fall and spring semesters and may be repeated with permission of the instructor.

10 **Beginning Badminton** (1) — **Breen**
13 **Beginning Ballet Technique** (1) — **Staff**
14 **Beginning/Intermediate Ballet Technique** (1) — Staff
17 **Beginning Modern Dance Technique** (1) — **Staff**
18 **Beginning/Intermediate Modern Dance Technique** (1) — Staff
19 **Dance** (1) — Staff
20 **Beginning/Intermediate Golf** (1) — **Staff**
21 **Foil Fencing** (1) — **Staff**
22 **Basketball** (1) — **Staff**
24 **Volleyball** (1) — **Staff**
26 **Tae Kwon Do (Korean)** (1) — Staff
27 **Beginning Tennis** (1) — **Staff**
28 **Intermediate Tae Kwon Do (Korean)** (1) — Staff
29 **Yoga** (1) — **Staff**
30 **Body Conditioning** (1) — Staff
31 **Roller Skating** (1) — Staff
32 **Beginning Swimming** (1) — **Staff**
33 **Swimming/Life Saving** (1) — **Staff**
34 **Intermediate Swimming** (1) — **Staff**
36 **Springboard Diving** (1) — **Staff**
37 **Soccer** (1) — Staff
38 **Racketball** (1) — **Staff**
39 **Handball** (1) — **Staff**
40 **Squash** (1) — **Staff**
41 **Team Handball** (1) — Staff
42 **Aerobic Dance** (1) — **Staff**
51 **Gymnastics** (2) — **Staff**
Emphasis on apparatus and trampoline.
52 **Dance Technique I** (1, 2, or 3) — Staff
53 **Dance Technique II** (1, 2, or 3) — Staff
54 **Intermediate/Advanced Tennis** (2) — **Staff**
Development of skills, theories of strategy; emphasis on competitive play as a lifetime sport.
55 **Swimming—Water Safety for Instructors** (2) — Staff
56 **Scuba Diving** (2) — **Staff**
Laboratory fee, amount announced in *Schedule of Classes*.
57 **Intermediate/Advanced Badminton** (2) — **Breen**
(Spring)
58 **Intermediate Ballet Technique** (1, 2, or 3) — Staff
59 **Team Sports** (2) — **Staff**
(Fall)
60 **Racket Sports** (2) — **Staff**
(Spring)
61 **Aquatic Leadership** (2) — **Staff**
(Fall)
62 **Conditioning/Weight Training** (2) — **Staff**
(Spring)
63 **Games and Movement Activities for Children** (2) — **Staff**
(Spring)
64 **Horseback Riding** (2) — **Staff**
Laboratory fee, amount announced in *Schedule of Classes*.

65 Skiing (2) Staff
Laboratory fee, amount announced in *Schedule of Classes*. (Spring)
66 Synchronized Swimming (2) Staff
68 Sport Clinics (2) Staff
Special intensive study and skill development.
100 Experimental Course (3) Staff

Second Group

101 Physical Education and Sports in Human Resource Centers (3) Snodgrass
Development of physical education and sports programs in schools and play settings. Includes philosophy and curriculum.

102 Movement Education (3) Snodgrass
Techniques of teaching movement education with emphasis on problem-solving methods for kindergarten and grades 1–6. (Fall)

103 Professional Foundations and Concepts of Human Kinetics and Leisure Studies (3) Snodgrass
Nature, scope, and scientific basis of human kinetics and leisure studies; orientation to professional competencies.

104 Introduction to Travel and Tourism (3) Davidoff
Survey of the travel and tourism industry with emphasis on the travel agency, marketing tourism and travel, research and development of tourist destinations, and the economic and social impact of tourism. (Fall)

105 Introduction to Therapeutic Recreation/ Adaptive Physical Education (3) Farbman, Songster
Philosophy, methods, and concepts relating to adaptive physical education and therapeutic recreation. (Fall)

106 Introduction to Dance Therapy (3) Greenbaum
General survey of dance therapy areas from theoretical and experimental points of view. Exploration of professional opportunities and training. (Fall)

107 Ethnic Dance (2) Johnson
Methods and materials of European folk and social forms of dance. Laboratory experiences assigned. (Spring)

108 Dance Improvisation (3) Woodson
Awareness of body movements, environment, group dynamics, performance and composition through improvisational technique. (Fall and spring)

109–10 Dance Composition (3–3) Withers
HKLS 109: basic elements and principles of composition. HKLS 110: advanced problems in composition. Prerequisite: HKLS 108 or equivalent. (Academic year)

111–12 Sports Education Technique (3–3) George
Techniques for teaching individual, dual, and team sports. (Academic year)

113–14 Practicum (3–3) Nashman
Pre-practice teaching or practical experience in elementary or secondary school physical education; adaptive physical education, dance, or tourism settings. Seminars relating to field experiences. (Academic year)

115 Movement Technique for Theater (2) Guidone
Basic body awareness, sensory awareness, and movement exploration. Analysis of movement and dramatic justification of movement. May be repeated for credit. (Fall)

116 **Mime Movement and Theater** (2) Staff
Fundamentals of mime for the beginner. Isolation and illusion exercises. Work with masks, building improvisation and set pantomimes. May be repeated for credit. (Spring)

117 **Dance Education** (3) Johnson
Organizational, methodological, philosophical and conceptual approaches to the teaching of dance in academic and nonacademic settings. Prerequisite: HKLS 157. (Fall)

118 **Special Problems in Dance Composition** (1) Staff
Work with elements of movement leading to short composition studies. Prerequisite: HKLS 109–10 or equivalent. (Fall and spring)

119 **Creative Dance for Children** (3) Withers
Dance as an expressive art medium for children; concepts, principles, methods and materials. Emphasis given to dance in elementary education with consideration for special education.

120 **Repertory** (1 or 2) Staff
Study and performance of dance works. Admission by permission of instructor. May be repeated for credit. (Fall and spring)

121 **Modern Dance Technique I** (1, 2, or 3) Staff
Intermediate/advanced modern dance. Prerequisite: HKLS 53 or equivalent. May be repeated for credit. (Fall and spring)

122 **Methods and Materials for Health Education** (3) Kane
Conceptual approach to curriculum design and teaching, including planning and organization, methodology, selection and use of materials and evaluation; basic health knowledge. (Spring)

123 **Modern Dance Technique II** (1, 2, or 3) Staff
Advanced modern dance. Prerequisite: HKLS 121 or equivalent. May be repeated for credit. (Fall and spring)

129 **Introduction to Motor Learning** (3) Stallings
Concepts of motor skill learning applied to teaching and coaching skills. (Fall)

130 **Introduction to Motor Development** (3) Snodgrass
Study of the evolvement and refinement of fundamental movement skills throughout the life span. (Spring)

133 **Student Teaching** (6 to 12) Nashman
Prerequisite: HKLS 113–14 or equivalent. Admission by permission of instructor. (Fall and spring)

135–36 **Dance History** (3–3) Johnson
Study of dance from antiquity to present; emphasis on cultural significance of dance as art, education, and social behavior. (Academic year)

137 **Dance and Movement Analyses** (3) Whipp
Concepts and elementary principles of movement analysis with emphasis on effort and shape. (Spring)

138 **Curriculum, Organization and Administration of Physical Education and Athletics** (3) George
Curriculum and administration related to physical education and athletic programs. Professional ethics.

139 **Coaching Behavior** (3) Snodgrass
Study of behavioral patterns and interactions related to individual and team sports. (Spring)

141–42 **Theater Production for Dance** (3–3) Staff
Theory and practicum in technical aspects of dance production, lighting, sound, theater management, costuming, make-up, publicity,

promotion, and audiovisual techniques. (Materials to be purchased) (Academic year) Staff

144 **Choreography** (3)
Solo and group. May be repeated for credit. Prerequisite: HKLS 109–10 or equivalent; HKLS 141–42 recommended. (Fall and spring) Stallings

150 **Introduction to Human Anatomy** (3)
Systematic study of the structure of the human body, with emphasis on joints, muscles, and neuromuscular mechanisms. (Fall) Paup

151 **Kinesiology** (3)
Analysis of human movement, including mechanical physics, anatomy, and physiology. Prerequisite: an approved course in anatomy (Spring) George

156 **Application of Recreational Skills to Contemporary Lifestyles** (3)
Development of recreational skills; emphasis on local opportunities for recreational activities. Current trends in community recreational development and program planning. May be repeated for credit with permission of instructor. (Fall and spring) Withers

157 **Dance Technique Theory** (3)
Theoretical foundations of dance. Applied principles of kinesiology, analysis and practice of contemporary dance techniques. (Fall) George

158 **Safety: Prevention, and Care of Sports Injuries** (3)
Safety education, liability, prevention and care of sports injuries related personnel, facilities, and equipment. Paup

164 **Physiology of Exercise** (3)
The physiological functions of the body and the effect of exercise on these functions. Prerequisite: HKLS 150 or permission of instructor. (Fall) Snodgrass

171 **Current Professional Literature and Competencies** (3)
Study of current literature with implications for HKLS specializations; use of library resources and retrieval systems; evaluation of professional competencies. Prerequisite: HKLS 103 or permission of instructor. Staff

172 **International Experiences** (1 to 6)
Travel to a foreign country for study of a specific topic. Staff

173 **Independent Study** (1 to 3)
Individually designed model for intensive study in an area of special interest. Prerequisite: demonstrated competency for independent work and permission of advisor and instructor. May be repeated for credit. Staff

175 **Music for Dancers** (3)
Rhythmic theory and analysis; resources in music and accompaniment principles for dance. Prerequisite: basic knowledge of rhythmic theory. (Spring, even years) Nadler

178 **Designing and Implementing Conferences and Meetings** (3)
Same as Educ 178. Staff

184 **Workshop** (1, 3, or 6)
Titles announced in *Schedule of Classes*. May be repeated for credit with permission of advisor. Donnels and Staff

187–88 **Sign Language and Deafness** (3–3)
Same as Educ 187–88. Davidoff

190 **Sales Management for Travel Agents** (3)
An in-depth study of agency products and services, with methodologies for maximum control and efficiency. (Fall)

191 **Business Management for Travel Agents** (3) Davidoff
Basic principles of business administration applied to small businesses in general and to travel agencies in particular. General management concepts (planning, organizing, leading, and controlling), with specific applications in management areas, including personnel, finance, office operations, law, and insurance. (Spring)

192 **Marketing Management for Travel Agents** (3) Davidoff
Marketing theories as applied to the travel agency. Coverage of the marketing mix in travel, market segmentation, market planning, and the use of advertising and other communications techniques. Emphasis on increasing profitability through planned marketing programs. (Fall)

193 **Domestic and International Tourism** (3) Davidoff
An overview of tourism theory, with emphasis on how such knowledge can help the travel agent understand and improve his or her function. Emphasis on the psycho-social aspects of tourism on the traveller and host community. Economic and social impacts are discussed. (Spring)

200 **Experimental Course** (3) Staff

Third Group

202 **Conceptual Basis of Motor Learning** (3) Stallings
Variables of perceptual motor learning and performance; theories, concepts, and models of learning applied to teaching and coaching. (Fall and spring)

205 **Perceptual-Motor Programs: Diagnostic-Therapeutic Techniques** (3) Stallings
Programs of perceptual-motor therapy and their basic assumptions and diagnostic-therapeutic techniques. (Spring)

230 **Advanced Concepts in Motor Development** (3) Snodgrass
Study and practice in techniques of critical observance and analysis of motor behavior throughout the life span, with special emphasis on period from birth to age eight and on the aged. (Fall)

232 **Current Issues in Elementary School Physical Education** (3) Snodgrass
Current philosophy, trends, and research; implications for curriculum, instruction, evaluation. (Spring)

239 **Administration of Therapeutic Recreation Services** (3) Staff
Development of recreation and tourism opportunities for disabled, elderly, and other special populations; emphasis on administrative competencies in community organization, communications, consultation, program development, evaluation, and fiscal management. (Spring)

240 **Physical Education for the Handicapped** (3) Songster
Adaptive physical education for handicapped populations; development of competencies in diagnostic-prescriptive teaching, program design and evaluation, consultation, and communications. (Fall)

244 **Therapeutic Recreation Practice** (3) Farbman
Professional competencies for delivery of therapeutic recreation services to handicapped populations in clinically oriented settings. Emphasis on client assessment, activity analysis, treatment programming, and relationship of therapeutic recreation to total rehabilitation goals. (Spring)

245 Medical Aspects of Disabilities and Handicapping Conditions (3) Ellis
Etiology, symptomology, and treatment of chronic and traumatic disorders associated with handicapping conditions: implications for programming and facility development as related to therapeutic recreation, adaptive physical education, and other therapies. (Fall)

249 Tourism, Recreation, and the Quality of Life (3) Houston
Impact of leisure on cultural development and social values; specific emphasis on psychosocial aspects of tourism and recreation. May be taken for undergraduate credit with permission of the instructor. (Fall)

250 Administration of Travel and Tourism Services (3) Hunt
Organization and management concepts, theories, and issues, stressing application of theory through analysis of short case examples drawn from the broader range of the travel and tourism industry.

251 Theories and Techniques of Leisure Lifestyle Planning (3) Smith
Overview of theories and concepts of leisure counseling, leisure education, and total leisure lifestyle planning. Emphasis on methods and techniques of leisure assessments, attitudinal change, and facilitating leisure planning for special populations as well as the general public.

252 Supervision in Therapeutic Recreation (3) Smith
Roles and functions of supervision in therapeutic recreation and service. Didactic and experiential activities related to problem-solving in supervision. Emphasis on group dynamics and interpersonal communication skills in supervisory responsibilities.

256 Sports Medicine (3) Brody
Theory, practice, and research in diagnostic treatment, rehabilitation, and prevention of sports-related injuries.

257 Principles and Concepts of Employee Health/Fitness Programs (3) Keelor
General overview of the employee health/fitness movement in the U.S. and other countries. Public and private health policy implications will be analyzed together with national economic and political trends relating to the subject. Evaluation of model programs, procedures, and current practice.

258 Organization and Management in Health/Fitness (3) Keelor
Analysis of organization and management theory as it applies to current political and economic problems related to the health and fitness industry. Emphasis on leadership development for resolving conflict and implementing change.

260 Tourism Development (3) Darling
Relationship of economic theory and principles to tourism development; applications of economic analysis techniques to the travel and tourism field. (Fall)

261 Planning for Tourism (3) Staff
Integrated planning for travel and tourism organizations, financial and physical development for comprehensive tourism projects: consideration of basic concepts, approaches, and models. (Fall)

262 Tourism Policy Analysis (3) Edgell, Hunt
Understanding components of tourism policy, development of tools for tourism policy analysis, and description of tourism organizations in the government and private sector. (Spring)

265 Sports and Politics (3) Troester
Political analysis applied to sports policy; comparative approach to the study of the relationships between ideology, economic de-

velopment, and the types and levels of government involvement in sports policy. (Spring)

270 **Philosophic Foundations of Dance** (3) Johnson
Examination and discussion of aesthetic theories in the arts and dance as a performing art, with application to criticism. (Spring)

271 **Dance Reconstruction** (1 to 3) Staff
Recreating the structure and dynamics of movement from dance scores. (Fall and spring)

273 **Advanced Choreography** (3) Staff
Group or solo choreography. Course work includes responsibility for auditions, rehearsals, and presentation in concert. May be repeated once for credit. Prerequisite: HKLS 144 or equivalent. (Fall or spring)

276 **Dance in Society** (3) Johnson
Anthropological aspects of dance; emphasis on current research and literature.

280 **Advanced Workshop** (1 to 3) Staff
Workshops with emphasis on contemporary issues and problems; development of advanced professional competencies. May be repeated for credit with permission of advisor. (Fall and spring)

282 **International Experiences** (1 to 12) Staff
May be repeated for credit with approval of advisor.

283 **Practicum** (3 to 6) Staff
Field work, internship and/or instructional practice, including conference and/or seminar. May be repeated once for credit with permission of advisor. (Fall and spring)

290 **Advanced Seminar** (1 to 3) Staff
May be repeated for credit with approval of advisor. (Fall and spring)

293 **Independent Study** (1 to 6) Staff
May be repeated for credit with approval of advisor.

296 **Systems Analysis of Tourism Services** (3) Shafer
Quantitative analysis, resource identification, design techniques, and other systems approaches applied to travel and tourism services. (Fall)

297 **Advanced Topical Studies** (3) Breen and Staff
Independent research and study pertinent to the needs of the student. Prerequisite: Educ 295 or permission of instructor. (Fall and spring)

298 **Thesis Research** (6) Staff

Fifth Group

701 **Experimental Course** (3) Staff

721 **Experimental Course—Interdepartmental** (3) Staff

INDIVIDUAL GRADUATE PROGRAMS

Committee on Individual Programs

W.B. Griffith *(Chairman and Program Director)*, B. Catron, J. Cordes, R. French, T. Hufford, P. Lengermann, C. Rice

The Graduate School of Arts and Sciences offers the course listed below primarily for students with individualized interdisciplinary programs of study for the Master's degrees in Special Studies. The Committee on Individual Programs,

which has supervisory responsibility for Individual Programs students, provide the faculty for the Colloquium.

250 **Colloquium on Interdisciplinary Methodologies** (3) Staff
Analysis from several perspectives of the problems inherent in inter disciplinary study and research, conditions which justify interdis plinary work, norms and strategies for success, and case studies Required for all students in Individual Programs. Open to other inter disciplinary students with permission of the Colloquium Directo (Spring)

INSTITUTE FOR SINO-SOVIET STUDIES

Members of the Institute
G. Sigur *(Director)*, M. Atkin, C.F. Elliott, A. Gyorgy, H.C. Hinton, W.R Johnson, Y. Kim, C.A. Linden, C.A. Moser, J. Pelzman, V. Petrov, C. Shih M. Sodaro, R. Thornton, S. Wolchik, R.Y. Yin

Associate Members of the Institute
J. Banister, J.J. Dziak, E.M. Hadley, J. Hardt, T. Hsia, W.H. Lewis, B. Ra mundo, P.A. Smith, E.L. Warner

The Institute for Sino-Soviet Studies offers specialized graduate study in the School of Public and International Affairs. Students who lack background in Soviet and East Asian studies are required to take undergraduate courses selected by the advisor as prerequisite to graduate work. Related preparatory undergraduate courses include the following: Econ 101, 102, 133, 134, 169, 170 Hist 137, 138, 143, 144, 145, 146, 187, 188, 189, 195, 196; PSc 1, 9, 106, 107, 108 131, 165, 168, 170, 173; Psyc 151.

For description of the objectives and programs of the Institute, see page 179. For description of the courses listed below, see the appropriate departmental listing.

ECONOMICS

267 *Seminar: Soviet Economy* (3) Hardt
268 *Seminar: Economic Theory and Development in Communist Countries* (3) Hardt
269 *Economy of the People's Republic of China I* (3) Yin
270 *Economy of the People's Republic of China II* (3) Yin
271 *Economy of Japan* (3) Hadley
281 *International Economics* (3) Pelzman
367 *Seminar: Soviet Planning in Theory and Practice* (3) Pelzman

GEOGRAPHY AND REGIONAL SCIENCE

224 *Seminar: Political Geography* (3) Pederson
265 *Seminar: Geography of the Soviet Union* (3) Staff
266 *Seminar: Geographic Perspectives on Contemporary China* (3) Banister

HISTORY

205 *Evolution of Nationalism in Eastern Europe* (3) Petrov

206 *Readings Seminar: Revolution in Eastern Europe* (3) Petrov
215 *Readings Seminar: Communist Monolith that Never Was* (3) Petrov
217 *Readings/Research Seminar: Russian and Soviet Thought* (3) Atkin
232 *Comparative Communist Systems I* (3) Wolchik
233 *Comparative Communist Systems II* (3) Wolchik
237 *Readings Seminar: Soviet Foreign Policy, 1917-1964* (3) Petrov
246 *Readings/Research Seminar: History of Modern Russia and Soviet Union* (3) Atkin
253 *Readings Seminar: History of Sino-Soviet Relations* (3) Thornton
254 *Research Seminar: History of Sino-Soviet Relations* (3) Thornton
255–56 *Readings/Research Seminar: U.S.-Soviet Strategic Relations Since World War II* (3–3) Thornton
258 *Communist Party of the Soviet Union* (3) Sodaro
288 *Research Seminar: History of Chinese Communism* (3) Thornton
289 *Readings/Research Seminar: Modern Japanese History* (3) Sigur
295–96 *Readings Seminar: Modern East Asian History* (3–3) Johnson

POLITICAL SCIENCE

207 *Readings in Socialism and Communism* (3) Elliott, Linden, Wolchik
208 *Readings in Marxism and Leninism* (3) Elliott, Linden
230 *Comparative Government and Politics I* (3) Kim, McClintock
231 *Comparative Government and Politics II* (3) Kim, McClintock
232 *Comparative Communist Systems I* (3) Wolchik
233 *Comparative Communist Systems II* (3) Wolchik
258 *Communist Party of the Soviet Union* (3) Sodaro
263 *Communism in Non-Communist Europe* (3) Sodaro
264 *The International Politics of Eastern Europe* (3) Gyorgy
265 *Governments and Politics of Eastern Europe* (3) Gyorgy
266 *Readings in Soviet Government and Politics* (3) Elliott, Linden
267 *Soviet Government and Politics* (3) Elliott, Linden, Wolchik
268 *Soviet Foreign Policy* (3) Elliott
269 *Soviet Military Policy and Strategy* (3) Elliott
270 *Politics of the People's Republic of China I* (3) Hinton
271 *Politics of the People's Republic of China II* (3) Hinton
272 *Foreign Policy of the People's Republic of China* (3) Hinton
275 *International Politics of the Far East* (3) Hinton
276 *Government and Politics of Japan and Korea* (3) Kim
291 *Colloquium: East Asia* (3) Hinton
292 *Colloquium: Russia and Eastern Europe* (3) Gyorgy

INTERNATIONAL AFFAIRS

See **School of Public and International Affairs.**

ITALIAN

See **Romance Languages and Literatures.**

JAPANESE

See **East Asian Languages and Literatures.**

JOURNALISM

Professorial Lecturers F.L. Dennis, C.W. Puffenbarger, J. Coldsmith
Associate Professors **R.C. Willson, P. Robbins *(Chairman)***
Adjunct Associate Professor J. Deakin
Associate Professorial Lecturers R.L. Courage, J.P. McGill, E. Rogers, W.F. Fonda, C. Blount, R.R. Mueller, T.O. Cron, D. Haun, J.P. Martin, J.R. Fogarty, D.L. Smith, B. Taylor, S.B. Welchman, J.P. Jones, F.G. Graves

Bachelor of Arts with a major in journalism (departmental)—The following requirements must be fulfilled:

1. The general requirements as stated on pages 71–72, 79–85. (Students planning to major in journalism should take Engl 11 rather than Engl 12 in satisfying the English composition requirement.)
2. Prerequisite courses—Engl 51–52 or 71–72; Jour 71–72; PSc 1 and 2 or 3 and 3.
3. Required courses in the major—24 hours of second-group courses in Journalism, including (a) Jour 111, 196, 198; (b) nine semester hours chosen from Jour 121, 125, 133, 135, 137, 138, 139, 151, 155; and (c) 6 semester hours chosen from Jour 115, 116, 117, 129, 140, 141, 142, 145, 146, 150, 160, 170, 190, 195.
4. Required as a minor area of concentration—a minimum of 18 semester hours of second-group courses, chosen in consultation with the major adviser in one other department or field of study.

Recommended electives: Econ 121, 142, 157, 161, 162, 181–82; PSc 110, 111, 112, 114–15, 116, 118, 119, 120, 122; Psyc 115; SpDr 132, 133, 134, 135–36; Stat 52, 97, 105.

Minor in journalism—The student must complete 21 semester hours of journalism, including Jour 71 or 72; Jour 111; one course selected from Jour 115, 116, 117, or 170; three courses selected from Jour 121, 125, 133, 135, 137, 138, 139, 151, or 155; and any one other journalism course.

Departmental prerequisite: Jour 111 is prerequisite to Jour 125, 133, 135, 137, 138, 139, 190 and 196.

First Group

71–72 Introduction to Mass Communication (3–3) Willson
Jour 71: evolution of newspapers and other media in relation to political, social, and economic life; concept of press freedom. International students who lack knowledge of U.S. history should take Hist 71–72 before taking Jour 71. Jour 72: mass media, problems of contemporary journalism, emphasis on federal government-media relations. (Academic year)

Second Group

111 Reporting (3) Robbins
Gathering, evaluating, and writing news. Typing required. Laboratory fee, $10. (Fall and spring)

115 Newspaper Editing and Make-up (3) Coldsmith, Taylor
Preparation of news copy, pictures, and other graphic material for publication; evaluation of news; page layouts; newspaper make-up. (Fall and spring)

116 **Magazine Layout and Design** (3) Smith
Layout, typography, and design for magazines, newsletters, house organs, and similar publications for associations, institutions, and industry. (Fall)

117 **Magazine Editing** (3) Graves
The editor's responsibility to publisher and readers. Setting the editorial goals and planning content and production to meet them. Editing copy for general and specialized magazines. (Spring)

121 **Feature Writing** (3) Willson
Free-lancing nonfiction articles, materials obtained through independent investigation. (Fall)

125 **Science Writing** (3) Staff
Writing science news for the mass media. (Spring)

129 **TV News: The Politics of Visibility** (3) Lichter
Same as PSc 129.

133 **Advanced Reporting: Community News** (3) Puffenbarger
Coverage and writing of local news. (Fall)

135 **Advanced Reporting: Consumer Affairs** (3) Cron
Specialized training in the consumer news field. (Fall)

137 **Advanced Reporting: National Affairs** (3) Fogarty
Coverage and writing of federal government news. (Fall)

138 **Investigative Reporting** (3) Puffenbarger
In-depth reporting in selected areas of political, economic, and social affairs. Prerequisite: Jour 133 or permission of instructor. (Spring)

139 **Advanced Reporting: Radio and Television News** (3) Blount
Preparing news and public affairs programs for broadcast media. (Spring)

140 **Photojournalism** (3) Fonda
Taking and processing photographs for publication, picture selection, cropping, captions. Students must purchase their own film and print paper. Laboratory fee, $35. Students who received credit for Art 23 or 24 cannot receive credit for Jour 140. (Fall and spring)

141 **Intermediate Photojournalism** (3) Welchman, Haun
Advanced news and feature photography, editing, layout and photo essays. Students must purchase their own film and print paper. Laboratory fee, $35. Prerequisite: Jour 140 or Art 23 and 24. (Spring)

142 **Advanced Photojournalism** (3) Staff
Picture stories and photo essays in black and white or color; emphasis on layout, captions, text. Students must purchase own film and print paper. Laboratory fee, $35. Admission by permission of instructor. (Spring)

145 **Principles and Problems of Public Relations** (3) McGill, Mueller
Principles, problems, and ethics of public relations for government agencies, commercial establishments, educational and other public institutions. Case histories of successful programs. (Fall and spring)

146 **Government Information** (3) Courage
Growth of information activities in government and the role of the information specialist. Writing and editing for government information operations. (Spring)

150 **News Coverage in Washington** (3) Willson
The Washington news beats, channels and sources of news in the nation's capital, uses and abuses of the media. Field trips to local news centers and press briefings.

151 Editorial Writing (3) Robbins
Techniques of editorial writing, conducting the editorial page, func-
tion of editorials and columns of news commentary in a free press.
(Spring)

155 Critical Writing and Reviewing (3) Martin
Reviewing and commenting on the arts and entertainment for the
mass media. (Fall)

160 New Directions of Journalism (3) Robbins
A survey of the impact of fiction techniques on modern nonfiction
reportage. Study of selected writers to identify influences and trends.

170 News Publication Management (3) Coldsmith
The business side of publishing. Study of the roles of advertising,
circulation, promotion, accounting and administration, and mechan-
ical departments in newspapers and other publications. (Spring)

190 Internship in Journalism (3)
Study of a journalistic medium in action by working in a Wash-
ington area news office. Admission restricted to senior journalism
majors selected by a departmental committee. (Fall and spring)

195 Documentary Photography (3) Battaglia
Same as Art 195.

196 Senior Project (3) Staff
Open only to journalism majors. Major journalistic effort undertaken
in consultation with a member of the journalism staff. A written
request describing the project must be presented to the staff member
for approval, and filed with the student's advisor in the semester
before registration. (Fall and spring)

198 Law of the Press (3) Dennis
Freedom of the press, censorship, legislative controls, publication as
contempt of court, copyright, newsgathering agencies, labor law and
the newspaper business, law of libel, privileged matter, fair com-
ment on public characters, right of privacy. (Fall)

199 Special Topics in Journalism (3) Staff
Selected topics: writing, editing, graphics, photojournalism, or other
aspects of communication. May be repeated for credit.

JUDAIC STUDIES

Committee on Judaic Studies
D.A. Altshuler *(Chairman)*, R.H. Davison, R.G. Jones, T.Z. Lavine, B. Nimet, D. Pollock, B. Reich, H.M. Sachar, M. Ticktin, H.E. Yeide, Jr., J.E. Ziolkowski

Columbian College of Arts and Sciences offers an interdisciplinary program in Judaic Studies leading to the degree of Bachelor of Arts. This program is intended for students who wish to investigate the history, language, literature, religious and philosophical thought, and political and social experience of the Jewish people from the perspective of several academic disciplines. (Students who wish to concentrate on the religious aspects of Judaism and its relationship to the other religious traditions of the world may prefer to elect a major in religion with an emphasis on Judaism [see page 435].)

Bachelor of Arts with a major in Judaic Studies (interdepartmental)—The following requirements must be fulfilled:

1. The general requirements as stated on pages 71–72, 79–85.
2. Prerequisite courses—Clas 21–22, 23–24; Rel 9, 23.

3. Required courses for the major (30 semester hours):
(a) Clas 103 or 104; Hist 158; PSc 179; Rel 113–14 or 115–16, 213 or 238.
(b) two meaningfully related courses selected from each of two of the following groups: I—Anth 177, 180; Art 111, 112; II—Clas 100, 101, 102; Engl 175; III—Hist 107, 108, 110, 113, 114, 121, 122, 123, 124, 139, 140, 171, 172, 193, 194, 292, 293, 294; IV—Phil 111, 112, 113, 127, 131, 172; V—PSc 177, 178, 277, 278, 290; VI—Rel 103, 104, 105, 107, 111, 122, 126, 137, 143, 144, 145, 146, 161, 162, 172, 174, 181, 184, 209, 291, 292.

Students applying for the 90-hour degree program in Judaic Studies must, in addition to meeting the general requirements (see pages 80–81), present evidence of exceptional preparation in the field of Judaism, provide strong recommendations from high school teachers and/or counselors, and complete a satisfactory interview with the Committee on Judaic Studies.

Minor in Judaic Studies—Required: A minimum of 18 semester hours, chosen in consultation with an advisor designated by the Committee on Judaic Studies, from Clas 21–22, 23–24, 25–26, 100, 101, 102, 103, 104; Hist 158; PSc 179; Rel 9, 23, 103, 107, 113, 114, 115, 116, 174, 184, 209, 213, 238.

LATIN

See Classics.

LATIN AMERICAN STUDIES

Committee on Latin American Studies
J. Gordon *(Chairman)*, C. Allen, B.L. Boulier, T.F. Carroll, M. Grow, J. Grunwald, R.L. Humphrey, Jr., P.F. Klarén, M. Koch-Weser, E. Marasciulo, C. McClintock, T. Morrison, G. Palacios, J.W. Robb, L.R. Scheman, F.R. Siegel

Bachelor of Arts with a major in Latin American Studies (interdepartmental)—The following requirements must be fulfilled:
1. The general requirements as stated on pages 71–72, 79–85.
2. Required courses in related areas—Span 1–2, 3–4; or equivalent. (Span 5–10 or equivalent is recommended.)
3. Required courses in the major—(a) Anth 172, 185, or 190; Econ 185; Geog 161; Hist 163–64; PSc 183–84; and six semester hours chosen from Span 151–52, 155–56, 157–58, or other approved courses; (b) 18 semester hours, including an interdisciplinary seminar (287) in one of the following areas: anthropology, economics, geography and regional science, Hispanic literatures, history or political science. The required courses listed in (a) which are in the selected area may be included in computing the required 18 semester hours for (b).

Minor in Latin American Studies—Required: one Latin American course in each of the six member disciplines (anthropology, economics, geography, history, political science, and Spanish-American literature). Two years (or equivalent) of Spanish language is prerequisite.

Master of Arts in the field of Latin American Studies—See the School of Public and International Affairs, pages 162–79.

Candidates for the degree of Doctor of Philosophy may elect Latin American history as an area of specialization in the field of history, Spanish American literature as an area of specialization in the field of Romance languages and literatures, or politics of Latin America as an area of specialization in the field of political science.

Courses Dealing with Latin America:

Anthropology—115, 170, 172, 185, 190, 215, 262, 268, 272, 282, 287
Economics—185, 233, 234, 251, 252, 285–86, 287, 290, 291
Geography and Regional Science—127, 133, 161, 223, 250, 261, 287, 290, 29
History—161, 162, 163-64, 165, 166, 261, 262, 287
***Political Science*—183, 184, 283, 284, 285**
***Portuguese*—31–32**
Spanish—91–92, 141, 143, 151–52, 155–56, 157–58, 253, 255, 256, 261, 26
266, 287

LITERATURE—INTERDEPARTMENTAL GRADUATE STUDIES

Committee on Interdepartmental Literature Studies
G. Ludlow *(French)*, N.N. Natov *(Slavic)*, J.A. Plotz *(English)*, J.A. Quit
lund *(English)*, P.G. Sáenz *(Spanish)*, K. Thoenelt *(German)*

Interdepartmental Literature Studies seeks to provide graduate students
departmental literature programs with a greater understanding and appre
tion of the interrelated aspects of Western literatures. The courses offered
under the direction of a committee whose members are drawn from the vari
modern literature departments within the University.

Courses are offered for Masters (non-thesis) and doctoral candidates in c
or more of the following literatures: English, French, German, Russian, Spani
and Spanish-American. Participating departments have agreed that candidate
for graduate degrees may take a maximum of 6 semester hours of course wo
outside their own department as credit towards their Masters and doctora
degrees. Courses in foreign literatures are conducted in English and/or
foreign language, at the discretion of the instructor. All courses are open
qualified undergraduate students as elective credit when taken outside of
major field. Students should consult with the departmental committee mem
and the course instructor before selecting courses.

For description of the courses listed below, see the appropriate departmen
listing. Course offerings will not be restricted to the present listing.

ENGLISH

Quitslund
Plotz
Pass
Quitslund
Plotz

125–26 *Elizabethan Verse and Prose* (3–3)
133–34 *The Romantic Movement* (3–3)
157 *20th-Century Drama* (3)
225–26 *Studies in 16th-Century English Literature* (3–3)
233–34 *Studies in the Romantic Movement* (3–3)

GERMAN

Thoenelt
Thoenelt
Kl

111–12 *Comparative Studies in Germanic Literatures* (3–3)
126 *France and Germany* (3)
161 *Directed Readings in German Literature I* (3)

ROMANCE LANGUAGES AND LITERATURES

French

Cruz-Sá
Bur

135 *Comparative Medieval European Literature* (3)
229–30 *Literary Renaissance in Europe* (3–3)

241 *The Age of Enlightenment in Europe* (3) Ludlow
242 *Seminar: The French Novel and Theater in the 18th Century* (3) Ludlow
Ludlow

Spanish

135 *Comparative Medieval European Literature* (3) Cruz-Sáenz
137 *The Spanish Civil War and the Creative Artist* (3) Barnett

SLAVIC LANGUAGES AND LITERATURES

128 *Dostoevsky: The Man and the Artist* (3) Natov
156 *Leo Tolstoy: His Life and Works* (3) Rowe

MANAGEMENT SCIENCE

Professors M.M. Wofsey *(Emeritus)*, R.F. Ericson, G.L. Lippitt, D.D. Roman, P.B. Vaill, J. Harvey, E.B. Adams, W.E. Halal
Professorial Lecturers T. O'Connor, R.H. Walther, Z.A. Shavell
Associate Professors J.F. McCarthy, Jr., R.L. Holland, E.K. Winslow *(Chairman)*, W.W. Hardgrave, J.P. Coyne, E.H. Forman, S. Umpleby, E.W. Hahn, J. Lobuts, Jr., J.H. Carson, L. Graff, J.D. Frame

Programs of study leading to the degrees of Bachelor of Business Administration, Master of Business Administration, Master of Science in Information Systems Technology, Doctor of Business Administration, and Doctor of Public Administration are offered by the School of Government and Business Administration (see pages 131–62).

Second Group

107 **Fundamentals of Behavioral Science** (3) Lobuts and Staff
Survey of behavioral science research and practice as related to management. Emphasis on the basic human processes which contribute to the functioning of organizations.

118 **Introduction to Information Processing** (3) Carson, Coyne, Forman
Basic principles, terminology, and methods of computer data processing. Introduction to the use of the computer as a tool through assignments illustrating typical problems encountered in business and government data processing. Assignments involve flow charting and computer programming in a higher level language (FORTRAN) and are run on the SGBA computer. Laboratory fee, $25.

119 **Computer Programming for Information Systems** (3) Coyne, Carson
COBOL programming for business and government data processing applications. For students already familiar with basic computer concepts, flow charting, and programming. Emphasis on practical computer applications in accounting and management information systems. Prerequisite: Mgt 118 or Stat 97. Laboratory fee, $25.

120 **Information Systems Development I** (3) Coyne, Carson
Assessment of the systems concept and its relationship to organizational information decision-making and management. Concepts and techniques involved in the initial development of new or revised computer-based information systems, e.g., systems analysis and design phases. Prerequisite: Mgt 118, 119; or permission of instructor. Laboratory fee, $25.

121 **Information Systems Development II** (3) Carson, Coyne
A further examination of the information systems development

process, including concepts and techniques for assessment, selection, introduction, operation, and maintenance of a newly designed automated information system. Prerequisite: Mgt 120 or permission of instructor. Laboratory fee, $25.

122 **Special Studies in Information Systems** (3) Coyne, Carson
An independent or group-study project in information systems development which may involve faculty-supervised research, a case-study project, or field experience as an intern systems analyst in a local public or private organization. Prerequisite: Mgt 121 or permission of instructor.

Third Group

200 **Organization and Management** (3) Vaill, Adams, Ericson, McCarthy, Brown, Roman, Halal, Loeser
For designated students in the MBA program. Integrative approach to organizational concepts, management principles, philosophy and theory in public and private organizations. Evolution of management thought, functions, and practices, stressing present management approaches, general systems theory, and contingency management.

201 **Contemporary Issues in Management** (3) Adams, Halal, Vaill
An advanced management course designed to explore contemporary issues of organizations and management. Current literature and recent research findings will be analyzed. Topics include productivity, social responsibility, government regulations, consumerism, and employee participation. Prerequisite: Mgt 200 or equivalent.

210 **Individual and Group Dynamics in Organizations** (3) Lippitt, Harvey, Winslow, Vaill
For graduate students who wish to improve their skills in dealing with human behavior in organizations. Theoretical and personal understanding of the roles of interpersonal and group dynamics in management. Focus on individuals and groups in various organizational settings. Intensive work group experience focusing on theory, research, and group analysis.

211 **Current Issues in Organizational Behavior** (3) Winslow
Study of behavioral factors relating to issues such as automation, ethics, interpersonal relations, organizational change, and similar problems. Problems in behavioral science research. Prerequisite: Mgt 210.

212 **Behavioral Factors in the Process of Change** (3) Harvey, Winslow
Review of research, theory, and practice related to the process of human change. Students are provided the opportunity to apply their learning in various settings and to demonstrate competence in various media. This course emphasizes the relationship between theory and practice. Prerequisite: Mgt 210 or permission of instructor.

213 **Organizational Development: Concepts and Methods** (3) Lippitt, Harvey, Vaill
Primarily for doctoral students. Examination of different concepts of organizational structure, processes, and growth. Models of organizational change will be developed with a taxonomy of methods of initiating action to further organizational development. Prerequisite: Mgt 210, 212; or equivalent.

214 **Consultative Processes in Organizations** (3) Lippitt, Harvey
Examination through actual practice, as well as theory, of the nature of the helping process between one person or group and another person or group. Dynamics of the consulting process will be explored

as well as role differences in internal and external consultation. Development of skill in the helping relationship will be furthered. Prerequisite: Mgt 210, 212; or equivalent.

215 **Conflict Management: Theory, Concepts, and Methods** (3) Lippitt

Exploration of the ways power is used in conflict situations. Students will discuss and experience ways to make conflict a creative rather than a negative experience. Methods of conflict resolution will be practiced. Conflict in the micro (person-to-person) to macro (system-to-system) level will be explored. Prerequisite: Mgt 210 or permission of instructor.

218 **Computer Programming with Business Applications** (3) Graff, Hahn, Coyne, Carson, Forman

For designated students in the MBA program. Basic principles, terminology, and organization of computer systems. Emphasis on developing a proficiency in the use of higher-level programming language via computer solutions to production management and accounting problems. Laboratory fee, $25.

220 **Quantitative Factors in Administration** (3) Hahn, Forman, Hardgrave

Survey of quantitative techniques in solution of management problems. Potentials and limitations of mathematical models and proper areas for their application; use of the computer in solving such models. Linear programming, probability, decision-making under uncertainty, queuing and inventory models, simulation. Prerequisite: Mgt 202, 218, or equivalent. Laboratory fee, $10.

221 **Introduction to Probability Theory and Applications** (3) Hardgrave, Hahn, Forman

Introduction to probability theory and its applications in management science and operations research; foundation course for further study of advanced probabilistic methods in operations research. Sample spaces, conditional probability, common distributions, random variables, simple stochastic processes. Prerequisite: Math 52 or 54, or equivalent. (Fall)

222 **Mathematical Programming: Techniques and Applications** (3) Hardgrave, Forman, Hahn

Technical and applied considerations of linear programming and related methods. Mathematical and computational aspects of linear programming. Formulation of linear programming models. Studies of applications of linear programming. Introduction to integer programming, algorithms, and formulations. Prerequisite: Math 52 or 54, or equivalent. Laboratory fee, $10. (Fall)

223 **Techniques of Operations Research** (3) Hardgrave, Forman, Hahn

Survey and introduction to contemporary operations research techniques, including nonlinear programming, dynamic programming, inventory and queuing models and simulation. Applications of such methods as models of common processes. Prerequisite: Mgt 221, 222. (Spring)

229 **Modeling in Applied Operations Research** (3) Hardgrave

Advanced modeling exercises in applied operations research. Prerequisite: Mgt 223 or permission of instructor. (Spring)

230 **Administration of Research and Development** (3) Frame, Roman

Examination of technological, political, and economic factors affecting the R&D environment; operational aspects; management problems in military, governmental, and industrial organizations; project selec-

tion, resource allocation, personnel, planning and control, measurement and evaluation. (Fall and spring)

231 **Project Management** (3) Roman
Specialized aspects of project management, including development of requests for proposals; proposal preparation; project selection, management, and costing; and project managers. Project management skills applicable in a variety of organizational settings where projects are used to accomplish operational objectives.

232 **International Science and Technology** (3) Frame, Roman
Technology transfer to advanced countries and LDCs; the technological basis of trade; international licensing, patenting and co-production activities; science, technology, and economic development; international comparisons of scientific and technological capabilities; current global issues involving technology; global transfer of military technologies; expert controls of technology. Prerequisite: Mgt 230 or permission of instructor. (Fall and spring)

235 **Technological Entrepreneurship and Innovation** (3) Frame, Roman
An examination of the legal, organizational, personnel, financial, marketing, and production aspects of establishing and maintaining technology-based ventures. Special attention focuses on patent protection, trade secrets, licensing strategies, financial resources, tax implications, and venture management approaches. Case studies of recent high- and low-technology ventures. (Spring)

239 **Seminar: Administration of Research and Development** (3) Roman, Frame
Individual and/or group in-depth research projects dealing with various phases of research and development management. Topic will vary each time the course is offered according to the emerging technology, current operational problems, and student interest. Prerequisite: six to nine semester hours of research and development management or permission of instructor. (Fall)

240 **Survey of Information Technology** (3) Graff, Adams, Carson
Management-oriented survey of key areas in information technology, including hardware, software, systems development, management and the computing milieu. Prerequisite: Mgt 218.

241 **Information Systems Development and Application** (3) Carson
An advanced course in information technology, emphasizing philosophies, principles, and practices common to the development and application of information systems. Different approaches are studied, case study materials are evaluated, and the various roles of the technical staff are considered. Prerequisite: Mgt 118. (Fall and spring)

242 **Comparative Computer Systems** (3) Coyne
Characteristics and capacities of the range of information processing equipment in use today. Recent and prospective equipment and software development. Selection of computers and related software and equipment. Prerequisite: Mgt 240 or permission of instructor. (Spring)

243 **Management of Information Technology** (3) Adams
Advanced course emphasizing principles, practices, and trends in the management of information technology. Case studies. Prerequisite: Mgt 240, 242; or permission of instructor. (Fall)

244 **Information Systems and Telecommunications** (3) Carson, Forman
Principles of telecommunications; applications of telecommunication

for the transmission of data communications to enhance the flow of information within an organization. Identifying opportunities for applying technology in ways that will support the efforts of an organization. Terminology, hardware and software considerations, and calculations necessary for the specification and design of telecommunication systems. Prerequisite: Mgt 118. (Fall)

245 **Data Base Systems** (3) Coyne
An in-depth approach to the understanding and use of the latest techniques for developing and implementing an effective data base system. Topics include data base organization, creation, and maintenance; evaluation criteria; standardization of data base systems; impact of packaged data management systems; and analysis of the current state-of-the-art in data base development. Prerequisite: Mgt 118. Laboratory fee, $25. (Fall and spring)

246 **Workshop in Data Base Systems** (3) Coyne, Forman
Analysis and solution of complex information problems through commercially available data base systems; development of evaluation methodology, comparison of implementation strategies. "Hands-on" experience with at least four major commercial systems. Prerequisite: Mgt 119, 245. Laboratory fee, $25. (Fall and spring)

247 **Higher-Level Programming Languages for Information Systems** (3) Forman
Use of major programming languages in information technology. Topics for each language include syntax and semantics, ease of learning, coding and debugging, documentation standards and maintenance, suitability for particular problem areas and projected users; availability of languages on large-scale through minicomputers. A comparative analysis of these language and conversion problems is also discussed. Prerequisite: Mgt 118. Laboratory fee, $25. (Fall)

248 **Design of On-Line Information Systems** (3) Carson, Forman
Introduction to the analysis, design, and implementation of on-line business information systems. Topics include requirements analysis, functional specifications, file design, man-machine dialogue design, response time requirements, user psychology, human channel and buffer capacity. Prerequisite: Mgt 244; Math 51, 52. (Spring)

249 **Seminar: Information Technology** (3) Staff
Current trends in the design and implementation of computer-supported systems; emphasis on current state-of-the-art through discussion with leading experts in the field and analysis of literature. Prerequisite: Mgt 240, 242, 243; or permission of instructor. (Spring)

250 **Operating Systems** (3) Carson
Principles of operating systems; role of the operating system in resource allocation activities inherent in large-scale digital computers. The specialized functions of these systems are defined, and logical requirements of each are specified, including data structuring, multiprogramming, I/O spooling, and job control. Commercial operating systems will be studied as examples. Prerequisite: Mgt 120, 121. (Fall)

251 **Microcomputer Applications** (3) Hahn, Carson, Forman
An in-depth approach to the understanding and use of microcomputer systems. Principles of microcomputers and distinguishing characteristics among various microcomputer systems. Students work individually with the microcomputer system in the laboratory. Prerequisite: Mgt 122. Laboratory fee, $25. (Spring)

252 **Information Resources Management** (3) Adams
Concepts and tools for integration of information systems, manage ment systems, and organizational systems. Information as a resource cost and value assessments, budgeting and accounting structures, and evaluation of information as a resource. Prerequisite: Mgt 200, 240, or equivalent.

253 **Security and Privacy of Information Systems** (3) Adams, Forman
An advanced course in information technology, emphasizing the philosophies, principles, and practices of security management in and impact of privacy legislation on computer-based systems. Risk assess ment, state of the art measures, trends in the information security field, and roles of the various levels of management and technologica staff. Prerequisite: Mgt 218 or 240.

260 **Introduction to General Systems and Cybernetics** (3) Umpleby, Ericson, Adams
Analysis of fundamental general systems and cybernetic concepts evolving in various branches of knowledge and academic disciplines emphasizing their transcontextual and interdisciplinary nature, e.g. stability, equilibrium, homeostasis, feedback, regulation, equifinality self-organization, variety, uncertainty, redundancy, paradox, first- and second-order cybernetics, and self-reference.

261 **Fundamentals of General Management Systems and Organizational Cybernetics (GEMSOC)** (3) Ericson, Adams, Umpleby
Dynamics of organization and management from a general systems and cybernetics viewpoint. Translation of GEMSOC research and theory into the world of organizational behavior and management practice. Prerequisite: Mgt 260 or permission of instructor.

263 **Case Studies and Field Research in GEMSOC** (3) Ericson, Adams, Umpleby
Investigation of existing organizational structures and ongoing management processes from a GEMSOC standpoint. Operational evaluations of firms and agencies, including intercontextual comparative studies. Laboratory fee, $25. Prerequisite: Mgt 261.

264 **GEMSOC Modeling and Simulation** (3) Umpleby, Adams, Ericson
Literature review and current practice analysis; modeling and simulation exercises. Continuous and discrete representations: system dynamics, set theory, kinematic graphs, information theory. Prerequisite Mgt 261.

270 **Mathematics and Statistics for Management** (3) Hahn, Forman, Graff, Hardgrave
For designated students in the MBA program. Mathematical and statistical concepts employed in the solution of managerial problems. Applications of functions, elements of calculus and linear algebra. Introduction to probability, frequency distributions, statistical inference, regression, and correlation.

275 **Managerial Statistics I** (3) Forman, Hahn, Hardgrave
Statistical methods and their applicability to management. Topics include sampling, estimation, hypothesis testing, regression and analysis of variance. The student will learn how to utilize computer software packages in applying the statistical techniques. Prerequisite: Mgt 20 and 218 or equivalent. Laboratory fee, $25.

276 **Managerial Statistics II** (3) Forman, Hahn, Hardgrave
Statistical modeling of management applications. Topics include multiple regression, analysis of variance, analysis of covariance, surve

design and forecasting. The student will learn how to utilize computer software packages for statistical modeling. Prerequisite: Mgt 275 or permission of instructor. Laboratory fee, $25.

290 **Special Topics in Management Science** (3) Staff
Experimental offering; new course topics and teaching methods. May be repeated once for credit. Laboratory fee may be imposed, depending on requirements. (Fall or spring)

298 **Directed Readings and Research in Management Science** (3) Staff
(Fall and spring)

299 **Thesis Seminar** (3) Staff
(Fall and spring)

300 **Thesis Research** (3) Staff
(Fall and spring)

Fourth Group

Fourth-group courses are primarily for doctoral students. They are offered as the demand requires.

311–12 **Seminar: Public-Private Sector Institutions and Relationships** (3–3) Staff
An analysis and critique of alternative theoretical frameworks for describing, understanding, and predicting the nature, values, and actions of American public and private institutions. Problems, potentials, and alternatives for structuring public and private institutional arrangements to meet the needs of society. (Academic year)

328 **Seminar: Operations Research** (3) Hardgrave
Special topics and advanced applications in operations research, such as fuzzy set theory, catastrophe theory, or Markovian decision processes. May be repeated once for credit. Prerequisite: Mgt 228 or permission of instructor.

365 **Research Seminar in GEMSOC Theory** (3) Umpleby, Adams, Ericson
Advanced seminar on recent advances in GEMSOC. Examination of the sources of systems concepts in traditional fields; extension of existing theory into new areas. Prerequisite: Mgt 261.

366 **Philosophic and Policy Issues in Institutional Articulation** (3) Ericson
Need for greater institutional coherence of managerial decision-making in an "only one world" frame of reference. Systemic articulation and metasystemic integration: the planned evolution of more effective institutional forms. Institutional sovereignty, organizational morality, and human values: the search for general systemic optimality. Prerequisite: Mgt 365.

390 **Philosophical Foundations of Administrative Research** (3) Vaill
Philosophy of science as applied to research in administration. Topics include the nature and current problems of epistemology, the development and role of theories, and the relationship between theory, methodology, and empirical data. (Fall and spring)

391 **Methodological Foundations of Administrative Research** (3) Lauter
Examination of the process of social science research. Use of models and theoretical frameworks in research; formulation of research questions, hypotheses, operational definitions, research design, sampling methods, and data analysis approaches. Primary emphasis on the development of dissertation proposals. (Spring)

398 Advanced Reading and Research (arr.) **Staff**
Limited to students preparing for the general examination. May be repeated for credit. (Fall and spring)

399 Dissertation Research (arr.) **Staff**
May be repeated for credit. (Fall and spring)

MATHEMATICS

Professors D. Nelson, T.P.G. Liverman *(Chairman)*, H. Kenyon, C. Taam, R.L.A. Bari, I. Katz, H.D. Junghenn
Adjunct Professor J. Eftis
Professorial Lecturer C.F. Osgood
Associate Professors W.A. Smith *(Emeritus)*, D.R.K. Henney, I.I. Glick, M.D. Green, M.P. Lee, E.A. Stone, M.M. Gupta
Associate Professorial Lecturers C.M. Chambers, Y. Akiyama, M.A. Montemezzi, A. Heidrich, B. Jamil
Assistant Professorial Lecturers R.E. O'Brien, H. Beiman
Lecturers B.E. Gammon, S. Dillman, T.F. Wolfinger

Bachelor of Arts or Bachelor of Science with a major in mathematics (departmental)—The following requirements must be fulfilled:

1. The general requirements as stated on pages 71–72, 79–85.
2. Prerequisite courses—Math 31, 32, 33. (Math 30, a prerequisite to Math 31, may be waived upon examination before registration.)
3. Required courses in the major—a minimum of 24 semester hours of second-group courses in mathematics, including Math 106, 121, 123, 139 and 140. It is also strongly recommended that students take French, German, or Russian, and mathematically related courses in such subjects as physics, statistics, economics and engineering.

Bachelor of Arts or Bachelor of Science with a major in applied mathematics (departmental)—The following requirements must be fulfilled:

1. The general requirements as stated on pages 71–72, 79–85.
2. Prerequisite courses—Math 31, 32, 33. (Math 30, a prerequisite to Math 31, may be waived upon examination before registration.)
3. Required courses in related areas:
   (a) Stat 189–90.
   (b) Eighteen semester hours to be selected, in consultation with the department advisor, from social and management sciences, engineering and physical sciences, or computer sciences. At least 12 semester hours must be chosen from one area, and at least six semester hours must be chosen from courses numbered 101 or higher. For courses in applied science, civil engineering, electrical engineering and computer science, engineering administration, mechanical engineering, and operations research, see the *School of Engineering and Applied Science Bulletin*.
4. Required courses in the major—a minimum of 24 semester hours of second-group courses in mathematics, including Math 111, 112, 139, 140, 181–82. It is also strongly recommended that students take French, German, or Russian.

Master of Arts in the field of mathematics—Prerequisite: a bachelor's degree with a major in mathematics from this University, or an equivalent degree.
Required: the general requirements, pages 89–96. Students must complete 30 semester hours of approved course work, with or without a thesis, and must pass a comprehensive examination.

Master of Arts or Master of Science in the field of applied mathematics—Prerequisite: a bachelor's degree with a major in mathematics or a related field such as statistics, a physical science, engineering, or economics.

Required: the general requirements, pages 89–96. Course work is divided between mathematics courses and courses from one area of application—economics, engineering (civil, computer science, electrical, engineering administration, mechanical, or operations research), physics, statistics, or urban and regional planning. Courses in the chosen area of application are selected in consultation with the relevant department.

Candidates for the degree of Master of Arts must complete 30 semester hours of approved course work, including Math 299–300 *Thesis Research*, and must pass a comprehensive examination. At least 15 semester hours must be in mathematics courses, with no more than 6 hours of these from second-group courses. The remaining courses are chosen from the selected area of application. Theses are jointly supervised by the department of mathematics and the department concerned with the area of application.

Candidates for the degree of Master of Science must complete 30 semester hours of course work and must pass a comprehensive examination. At least 15 semester hours must be in mathematics courses, with no more than six semester hours from second-group courses. There is no thesis requirement.

Master of Science for Teachers—Prerequisite: A bachelor's degree; at least 12 semester hours or equivalent in mathematics courses, including the equivalent of Math 31; experience in teaching mathematics at the secondary school level. Required: 30 semester hours of approved second- or third-group mathematics courses, including Math 168.

Doctor of Philosophy in the field of mathematics—Required: the general requirements, pages 89–91, 96–99. The department doctoral program committee, after consultation with the student, will stipulate (1) courses which must be taken to fulfill the 48-semester-hour requirement leading to the General Examination; (2) the two languages, selected from French, German, or Russian, which must satisfy the foreign language requirement; and (3) the four areas of study in which the student must prepare for the General Examination. The doctoral program committee will appoint a Director of Research when the student has selected (preferably early in the program) one of the following research fields for the dissertation: functional analysis (abstract differential equations, functional equations, generalized functions, groups of operators), group representations, linear algebra (matrix theory), logic, measure and integration, ordinary and partial differential equations, theory of numbers, and topology (general topology, analytic topology, topological groups).

Bachelor of Arts in Education and Human Development with a teaching field in mathematics- Prerequisite: the education curriculum, pages 111–12. Required: the mathematics option and the professional courses listed on page 115.

First Group

***3 College Algebra (3)** Morris and Staff

Equivalent to the standard two years of high school algebra with several additional topics. Prerequisite: one year each of high school algebra and high school geometry. (Fall and spring)

***6 Plane Trigonometry (3)** Morris and Staff

Prerequisite: two years of high school algebra and one year of high school geometry, or Math 3 (or concurrent registration therefor). (Fall and spring)

***9 General Mathematics I (3)** Staff

Logic, sets, foundations of the number system, abstract mathematical systems, groups. (Fall and spring)

* The School of Government and Business Administration does not accept credit for this course toward the B.B.A.

10 General Mathematics II (3) — Staff
Algebra, Euclidean and non-Euclidean geometries, probability and statistics, matrices. (Fall and spring)

30 Precalculus (3) — Bari and Staff
Set theory, inequalities, basic analytic geometry, functions and relations. Polynomial, trigonometric, logarithmic and exponential functions. Prerequisite: Math 3 and 6; or one and one-half years of high school algebra, one year of high school geometry and one-half years of high school trigonometry; or equivalent. Prior to registration, new students must take a placement examination in algebra and trigonometry. (Fall and spring)

31 Single-Variable Calculus I (3) — Kenyon and Staff
Differentiation and integration of algebraic functions, exponentials and logarithms with simple applications. Arc length. Conic sections. Prerequisite: Math 30 or equivalent.* (Fall and spring)

32 Single-Variable Calculus II (3) — Kenyon and Staff
Calculus of trigonometric and hyperbolic functions. Techniques of integration. Taylor formula. L'Hopital's rules. Infinite series; polar coordinates; 3-dimensional vectors. Prerequisite: Math 31. (Fall and spring)

33 Multivariable Calculus (3) — Kenyon and Staff
Vector-valued functions. Partial differentiation. Multiple integrals. Topics in vector calculus. Prerequisite: Math 32. (Fall and spring)

41 Calculus for Economists I (4) — Junghenn
Differentiation and integration of algebraic and elementary transcendental functions; marginal analysis for functions of one variable; optimization of functions of one variable applied to economics. Prerequisite: Math 30 or equivalent.* (Fall and spring)

42 Calculus for Economists II (4) — Junghenn
Elementary linear algebra with economics applications, including input-output models; partial derivatives; multiple integrals; marginal analysis for functions of several variables; optimization of functions of several variables applied to economics; infinite series. Prerequisite: Math 41. (Fall and spring)

†51 Mathematics for the Social and Management Sciences I (3) — Glick and Staff
Solution of systems of linear equations; notion of function; graph of function; sequences; differential calculus of functions of one variable; exponential and logarithmic functions. New students must take a placement examination in algebra prior to registration. (Fall and spring)

†52 Mathematics for the Social and Management Sciences II (3) — Glick and Staff
Integral calculus of functions of one variable; functions of several variables; partial derivatives, maxima and minima, Lagrange multipliers; matrix algebra, linear programming; difference equations and mathematics of finance. Prerequisite: Math 51. (Fall and spring)

Second Group

101 Introduction to Mathematical Logic (3) — Nelson
Introduction to proof theory and model theory of propositional and predicate calculi, computability, topics from foundations of mathe

* Math 30 may be waived as a prerequisite by examination on scheduled dates.
† Social and management science students with a strong record in high school mathematics are advised to take Math 31, 32, and 124 instead of Math 51 and 52. Economics students are advised to take Math 41 and 42.

matics. Open to sophomores with permission of department. Prerequisite: Math 32 or permission of instructor. (Fall)

102 **Axiomatic Set Theory** (3) Nelson
Zermelo-Fraenkel set theory, ordinals and cardinals, foundations of the real number system. Prerequisite: Math 101 or permission of instructor. (Spring, odd years, when demand warrants)

104 **Mathematics and Human Thought** (3) Staff
Philosophical and historical aspects of mathematics and its interplay with other disciplines from antiquity to modern times. Prerequisite: two years of high school mathematics. (Spring, even years, when demand warrants)

106 **Introduction to Topology** (3) Kenyon and Staff
Prerequisite: Math 139 or permission of instructor. (Spring)

107 **Introduction to Algebraic Topology** (3) Bari
Prerequisite: Math 122 and 139, or permission of instruction. (Fall, even years, when demand warrants)

111 **Mathematics for Engineers and Physicists I** (3) Stone and Staff
Differential equations. Laplace transform. Series solutions of differential equations. Boundary value problems. Prerequisite: Math 33. (Fall)

112 **Mathematics for Engineers and Physicists II** (3) Stone and Staff
Vector analysis. First- and second-order partial differential equations. Topics in complex variables. Prerequisite: Math 111. (Spring)

113 **Graph Theory** (3) Bari
Directed and undirected graphs; bridges, cutpoints, and blocks; connectivity; partitions; Eulerian and Hamiltonian graphs; planarity; coloring problems. Flow charts for computer applications. Prerequisite: Math 32. (Spring)

121–22 **Introduction to Abstract Algebra** (3–3) Katz
Selected topics in elementary number theory, groups, rings (including polynomial rings), and fields. Open to sophomores with permission of department. Prerequisite: Math 32 or permission of instructor. (Academic year)

123 **Linear Algebra** (3) Lee
Theory of vector spaces, linear transformations, and matrices. Quadratic and bilinear forms, spectral decomposition. Prerequisite: Math 121. (Fall)

124 **Introduction to Matrix Theory** (3) Liverman and Staff
Operations on matrices, linear equations, matrix inversion, vector spaces, characteristic roots and vectors. Hamilton-Cayley Theorem. Systems of linear difference and differential equations. Quadratic forms. Applications to economic, biological, and physical models. Prerequisite: Math 32 or 42 or permission of instructor. (Fall and spring)

125 **Linear Programming** (3) Katz
Simplex algorithm, degeneracy, the assignment problem, duality theorems, post-optimality, the transportation problem, integer programming, applications. Prerequisite: Math 123 or 124, or equivalent. (Offered when demand warrants)

134 **Introduction to Boundary-value Problems** (3) Gupta and Staff
Prerequisite: Math 111 or 142. (Spring, even years)

135 **Projective Geometry** (3) Staff
Prerequisite: Math 123 or 124, or equivalent. (Offered when demand warrants)

139 Advanced Calculus I (3) Junghenn, Taam
Topology of R^n. Continuous mappings. Uniform convergence. Differentiable mappings. Prerequisite: Math 33. (Fall)

140 Advanced Calculus II (3) Junghenn, Taam
Contraction maps, implicit function and differential equation theorems. Integration theory. Fourier series. Prerequisite: Math 139 or equivalent. (Spring)

141 Advanced Calculus III (3) Glick and Staff
Tensors, differential forms, Stokes theorem, introductory differential geometry. Prerequisite: Math 140. (Spring, even years, when demand warrants)

142 Introduction to Differential Equations (3) Taam and Staff
Linear and some nonlinear differential equations. Topics include existence theorems, stability, control theory, limit cycles, and applications to physics and ecology. Prerequisite: Math 139 and 123 or 124, or permission of instructor. (Fall)

153 Introduction to Numerical Analysis I (3) Gupta
Accuracy and precision. Linear systems and matrices. Direct and iterative methods for solution of linear equations. Sparse matrices. Solution of nonlinear equations. Interpolation and approximate representation of functions, splines. Prerequisite: Math 33 or equivalent and some knowledge of computer programming. (Fall, even years)

154 Introduction to Numerical Analysis II (3) Gupta
Numerical differentiation and integration. Solution of ordinary differential equations. Introduction to optimization theory, gradient techniques. Least squares and applications, data fitting. Prerequisite: Math 153 or permission of instructor. (Spring, odd years)

157 Introduction to Complex Variable Theory (3) Henney and Staff
Analytic functions. Power series. Contour integration and calculus of residues. Conformal mapping. Physical applications. Prerequisite: Math 139. (Spring)

168 Seminar: Curriculum Studies (3) Bari and Staff
Open only to candidates for the degree of Master of Science for Teachers, teachers for in-service training or students recommended by the department of education. Critical examination of secondary school mathematics, curricula, techniques and programs. Prerequisite: Math 31 and permission of instructor. (Offered when demand warrants)

181–82 Seminar: Applied Mathematics (3–3) Glick and Staff
Prerequisite: Math 140, Stat 189–90, some knowledge of linear algebra, senior status as major in Applied Mathematics. (Academic year)

191 Special Topics (arr.) Staff
Admission by permission of instructor. May be repeated for credit. Offered upon demand.

195 Reading and Research (arr.) Staff
Under the personal direction of an instructor. Limited to mathematics and applied mathematics majors with demonstrated capability. Prior approval of instructor required. May be repeated for credit. (Fall or spring)

Third Group
Courses marked with an asterisk (*) are offered every year. Courses listed by title alone are offered when, and with such contents, as demand warrants.

ALGEBRA

201–2 **Modern Algebra I and II** (3–3) Katz, Lee
Fundamental concepts of groups, rings, and fields. (Academic year)

203 **Modern Algebra III** (3) Lee

204 **Representation Theory** (3) Lee

205 **Matrix Theory** (3) Katz

206 **Topics in Algebra** (3) Staff

ANALYSIS AND APPLIED MATHEMATICS

*211 **Complex Analysis I** (3) Liverman and Staff
Topology of complex numbers; elementary functions; integrals; Cauchy's theorem; maximum modulus and Liouville theorem; Taylor and Laurent series; classification of singularities; contour integration; the residue theorem; continuation, multivalued functions, and branch points. Prerequisite: advanced calculus. (Fall)

212 **Complex Analysis II** (3) Henney and Staff
Harmonic functions, partial fractions. Mittag-Leffler theorem; entire functions, the Hadamard product theorem, the gamma function; Hurwitz's theorem, normal families of functions. The Riemann mapping theorem; analytic continuation, Riemann surfaces. Prerequisite: Math 211 or equivalent. (Spring, even years, when demand warrants)

213 **Applications of Complex Analysis** (3) Liverman and Staff
Topics chosen from potential theory and conformal mapping, special functions, asymptotic expansions; steepest descent, stationary phase, and WKB methods. Fourier and Laplace transforms, Wiener-Hopf method, dual and singular integral equations. Prerequisite: Math 211 or an undergraduate course in complex variables. (Spring, odd years, when demand warrants)

*214 **Measure and Integration Theory** (3) Junghenn and Staff
Lebesgue measure and integration in abstract spaces. Probability measures. Absolute continuity; Radon-Nikodym theorem; measure on product spaces; Fubini theorem. L^p spaces. Prerequisite: advanced calculus. (Spring)

*215 **Introduction to Functional Analysis** (3) Taam
Topological and metric spaces; Tychonoff theorem; completion of a metric space; Normed and Banach spaces; linear functionals and operators; Hahn-Banach theorem; principle of uniform boundedness; the closed-graph theorem and interior mapping principle; Hilbert spaces; eigenvalues, eigenvectors, invariant subspaces, and projection operators; operational calculus of functions defined on the spectrum. Prerequisite: advanced calculus. (Fall)

216 **Banach Algebras and Special Theory of Operators** (3) Taam
Gelfand theory of commutative Banach algebras; function algebras, Stone-Cech compactification; application to the spectral theory of operators, spectral theorem for bounded and unbounded operators. Prerequisite: knowledge of measure and integration, introduction to functional analysis, and Tychonoff and Stone-Weierstrass theorem. (Spring, odd years, when demand warrants)

217 **Introduction to Ordinary Differential Equations** (3) Glick and Staff
First course in ordinary differential equations; existence and uniqueness of solutions; continuity of solutions with respect to initial conditions; properties of linear systems. Prerequisite: advanced calculus. (Fall, even years)

218 Topics in Ordinary Differential Equations (3) — Staff

219 Partial Differential Equations (3) — Liverman

Classical and modern techniques for the exact and approximate solution of P.D.E.s. Separation of variables, Green's functions, variational methods, Hilbert space methods. Prerequisite: advanced calculus. (Spring, odd years)

220 Topics in Partial Differential Equations (3) — Liverman

221 Calculus of Variations (3) — Glick

222 Introduction to Numerical Analysis (3) — Gupta

Computer arithmetic and round-off errors. Solution of linear systems and nonlinear equations. Interpolation and approximations. Numerical differentiation and integration. Eigenvalues and eigenvectors. Prerequisite: knowledge of advanced calculus and computer programming. (Fall, odd years)

223 Numerical Solution of Ordinary and Partial Differential Equations (3) — Gupta

Initial and boundary value problems for ordinary differential equations. Error propagation, convergence and stability. Finite difference and finite element methods for partial differential equations. Prerequisite: knowledge of differential equations and computer programming. (Spring, even years)

224 Generalized Functions and Operational Methods (3) — Liverman

225 Theory of Generalized Functions and Distributions (3) — Liverman, Glick

226 Control Theory (3) — Staff

227–28 Introduction to System Theory (3–3) — Katz

229 Mathematical Programming (3) — Staff

230 Topics in Analysis (3) — Staff

231 Topics in Applied Mathematics (3) — Gupta

232 Topics in Numerical Analysis (3) — Junghenn

241–42 Mathematical Foundations of Stochastic Processes (3–3)

COMBINATORIAL MATHEMATICS

Bari

261 Combinatorics (3)

Generating functions, recurrence relations, counting theorems. Selected topics. Applications to statistical mechanics, information theory, design of experiments, operations research, linear and dynamic programming, network theory. Prerequisite: undergraduate modern algebra and linear algebra. (Spring, odd years) — Bari

262 Graph Theory (3)

Electrical and other networks, matroids, chemical isomers, crystal structure, linear programming, operations research, Markov chains, Feynman diagrams, selected topics in graph theory from introductory topics to problems currently of research interest. (Spring, even years) — Staff

263 Topics in Combinatorial Mathematics (3)

LOGIC

Nelson

271 Introduction to Mathematical Logic (3)

Propositional and predicate calculus (first order): syntax, formation rules, semantics, axioms, proof and deduction, object vs metalanguage, deduction theorem, compactness theorem, Gödel-Henkin completeness theorem, Craig's interpolation theorem, Beth's definability

theorem. First-order recursive arithmetic: incompleteness and undecidability. (Fall, odd years)

272 Topics in Logic (3) — **Nelson**

TOPOLOGY

281–82 **General Topology** (3–3) — Kenyon and Staff
General topological spaces, separation axioms, compactness and connectedness. Metrization, uniform spaces, and complete spaces. (Alternate academic years)

283–84 Topological Groups (3–3) — **Green**

285 Topological Vector Spaces (3) — **Junghenn**

287 Differentiable Manifolds I (3) — **Glick**

288 Differentiable Manifolds II (3) — **Glick**

289 Topics in Topology (3) — **Staff**

RESEARCH

*295 **Reading and Research** (3) — **Staff**
May be repeated once for credit. (Fall and spring)

Fourth Group

*398 **Advanced Reading and Research** (arr.) — **Staff**
Limited to students preparing for the Doctor of Philosophy general examination. May be repeated for credit. (Fall and spring)

*399 **Dissertation Research** (arr.) — **Staff**
Limited to Doctor of Philosophy candidates. May be repeated for credit. (Fall and spring)

MICROBIOLOGY—GRADUATE PROGRAMS

Professors R. Hugh, L.F. Affronti *(Chairman)*, K. Huang, M. Reich, P.D. Kind
Associate Professor G.V. Stokes

Master of Science in the field of microbiology—Prerequisite: a bachelor's degree with a major in biological or physical sciences from this University, or an equivalent degree. The undergraduate program must have included the following courses or equivalent: BiSc 11–12; Chem 11–12, 151–52, 153–54; Math 30, 32 (31 may be taken concurrently with the graduate program); Phys 1, 2.

Required: the general requirements, pages 89–96. A total of 30 semester hours is required, 24 hours of course work and six hours of thesis (Micr 299–300). The course work must include Micr 211 (if not taken prior to admission), plus Bioc 221–22; Micr 277–78; and completion of the biostatistics tool requirement. The remaining academic work should consist of graduate-level courses selected with the approval of the department.

Doctor of Philosophy in the field of microbiology—Required: the general requirements, pages 89–91, 96–99. Candidates must fulfill the tool requirement by completing biostatistics and by either passing a reading knowledge examination in French or German, or completing satisfactorily six semester hours in an approved tool option such as electron microscopy. The General Examination covers at least four fields, two of which must be in microbiological disciplines.

Research fields: clinical microbiology, determinative bacteriology, mycology, immunology, microbial genetics, microbial physiology, and virology.

211 Microbiology (4) — **Staff**
Survey of bacteria, viruses, rickettsiae, fungi, parasites, and immuno-

logical concepts. Prerequisite or concurrent registration: Bioc 221–22 or other biochemistry course, and permission of instructor. Laboratory fee, $20. (Fall)

212 **Pathogenic Bacteriology** (3) Hugh
Principles of bacteriology and pathogenic characteristics of bacteria with emphasis on pathogenesis, prevention, and control of bacterial diseases of man. Prerequisites: Micr 211 or equivalent. Laboratory fee, $20. (Spring)

214 **Tissue Cell Culture** (3) Staff
Fundamental aspects of tissue culture, with emphasis on mammalian cells. Specialized techniques and applications of cell culture procedures, emphasizing quality control practices. Prerequisite: Micr 211 or equivalent. (Spring)

215 **Parasitology** (2) Turner*
Study of host-parasite relationships. Clinical recognition of important parasites in medicine. (Fall)

219 **Scientific Writing** (1) Wagner† (Fa
A basis for preparing theses, dissertations, and publications. Reich

225 **Microbial Physiology I** (3)
Microbial structure, nutrition, transport, growth, genetics, metabolism, and regulatory mechanisms. Prerequisite: Bioc 221–22, Micr 211 or equivalent. (Fall)

226 **Microbial Physiology II** (3) Reich, De Giovanni-Donnelly‡
The actions of antimicrobial agents and antibiotics on the structure and biochemistry of microorganisms at the cellular and molecular level. Prerequisite: Micr 225 or permission of instructor. (Spring

227 **Microbial Physiology Laboratory** (2) Reich
The application of laboratory techniques and instrumentation to topics covered in Micr 225 and 226. Prerequisite: Micr 226. Laboratory fee, $20. (Fall)

229 **Immunology** (3) Kind, Affronti
Lecture course. Fundamental immunologic concepts. Antigens, antibodies, antigen-antibody reactions *in vitro* and *in vivo*, and the immune response. Prerequisite: Micr 211 or permission of instructor. (Fall)

230 **Immunology Laboratory** (2) Kind, Affronti
Emphasis on methods in serology, immunochemistry, and cellular immunology that are used in research laboratories. Prerequisite or concurrent registration: Micr 229 or permission of instructor. Limited to students enrolled in a degree program. Laboratory fee, $
(Fall, odd years)

231 **Immunobiology** (1) Affronti, Kind
Study of immunological functions of reticulo-endothelial tissues, theories of auto-immunity, graft rejection, tumor immunity, delayed hypersensitivities, and immunogenetics. Clinical faculty discuss relevant aspects of immunobiology. For medical students; open to graduate students. Prerequisite: Micr 201§ or 229, and permission of instructor. (Fall)

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* Virginia M. Turner is Adjunct Assistant Professor of Parasitology in Microbiology in the G.W.U. School of Medicine and Health Sciences.

† Gerald Eugene Wagner is Assistant Professor of Microbiology in the G.W.U. School of Medicine and Health Sciences.

‡ Rosalie Frances De Giovanni-Donnelly is Associate Professorial Lecturer in Microbiology in the G.W.U. School of Medicine and Health Sciences.

§ For description of Micr 201 see the *School of Medicine and Health Sciences Bulletin.*

233 Virology (3) **Stokes**
Biochemical, genetic, and pathogenic characterization of viruses. Prerequisite: Micr 211 or equivalent. (Fall)

234 Virology—Laboratory (2) **Stokes**
Laboratory complement to Micr 233. Prerequisite or concurrent registration: Micr 233. Laboratory fee, $20. (Fall)

235 Systematic Bacteriology (2) **Hugh**
History of bacterial classification, international rules of bacterial nomenclature, development of bacterial classification based on relationships, characteristics of bacterial groups. Prerequisite: Micr 212 or equivalent. (Fall, odd years)

251 Clinical Laboratory Bacteriology (3) **Hugh**
For graduate students; open to medical students. Detection and identification of bacterial agents which cause diseases in humans. Comparative isolation and identification methods; emphasis on interpretation and significance of laboratory observations. Prerequisite: Micr 212 or equivalent. (Fall, even years)

252 Medical Parasitology (1) **Turner**
Lecture and laboratory course. The life cycles, epidemiology, clinical manifestations, pathology, diagnosis, treatment, and prevention of medically important protozoan and helminthic infections. In the laboratory, emphasis is placed on the recognition and identification of the etiologic agents causing disease through the study of living and preserved specimens. For medical students; open to graduate students. (Fall)

255 Clinical Virology (1) **Huang**
General principles of virology; emphasis on clinical situations. For medical students; open to graduate students. Prerequisite: Micr 212 or equivalent. (Fall)

257 Experimental Immunochemistry (3) **Affronti**
Biochemical and physiochemical characterization of antigens and antibodies. Prerequisite: Bioc 221-22 or equivalent, Micr 229. Laboratory fee, $20. Limited enrollment. (Spring, even years)

258 Microbial Genetics (2) **De Giovanni-Donnelly**
Survey of microbial systems that depict basic concepts of genetic principles. Prerequisite: Micr 211 or equivalent. (Spring)

260 Cellular Immunology (1) **Kind**
Advanced seminars in cellular aspects of the immune response. Content differs each time course is offered. May be repeated for credit. Prerequisite: Micr 229. (Spring)

277–78 Seminar: Microbiology (1–1) **Staff**
Required of graduate students. (Academic year)

293 Special Topics in Microbiology (arr.) **Staff**
Selected topics in microbiology. May be repeated for credit. (Fall and spring)

295 Research in Microbiology (arr.) **Staff**
Content differs each time the course is offered; may be repeated for credit. (Fall and spring)

299–300 Thesis Research (3–3) **Staff**
(Fall and spring)

398 Advanced Reading and Research (arr.) **Staff**
Limited to students preparing for the Doctor of Philosophy general examination. May be repeated for credit. (Fall and spring)

399 Dissertation Research (arr.) **Staff**
Limited to Doctor of Philosophy candidates. May be repeated for credit. (Fall and spring)

MUSEUM STUDIES—GRADUATE PROGRAM

Committee on Museum Studies

J.C. Anderson, A.D. Andrews, R.L. Humphrey, M.P. Lader, B. Mergen, R.K. Packer, C.R. Rose, M.S. Shapiro *(Director)*

The Committee serves the Museum Studies Program in an advisory capacity. Its members are drawn from several departments of the University and from the Smithsonian Institution.

The Graduate School of Arts and Sciences offers an interdepartmental program leading to the degree of Master of Arts in the field of museum studies. This program provides students with a broad background in museum studies, including a variety of specialized approaches to museum work, with concentrations in museum administration, collections management/preventive conservation, and museum programs.

The Program is designed primarily to prepare students to work with historical and scientific collections. Students whose principal career interests are in art collections and galleries should apply for candidacy in the program for the Master of Arts in the field of art history with a concentration in museum training, offered by the Art Department. Students whose career interests are primarily in curatorial positions with ethnographic and archaeological materials should apply for candidacy for the Master of Arts in the field of anthropology, with a concentration in museum training. Students whose career interests are primarily in curatorial positions with historical materials should apply for candidacy for the Master of Arts in the field of American studies, with a concentration in museum training. Students whose career interests are in museum education should apply for candidacy in the program for the Master of Arts in Teaching—Museum Education, offered by the School of Education and Human Development.

Students applying for candidacy in the Museum Studies Program must meet all general requirements for admission to the Graduate School of Arts and Sciences, including a baccalaureate degree with a major, or its equivalent, in anthropology, art history, American studies, or natural science. In addition, the student should have taken at least six credit hours in each of these fields and at least nine credit hours in one of them, other than the student's undergraduate major, or must show equivalent preparation.

Master of Arts in the field of museum studies—Required: the general requirements, pages 89–96. The degree requires a minimum of 42 hours of course work. At least 15 hours of course work must be in an academic core discipline, for example, American studies, anthropology, biological sciences, geology and paleobiology, public administration, or an appropriate interdisciplinary combination. At least 15 hours of course work must be in museum studies courses in conservation, museum administration, and exhibiting. Six to 12 hours must be in a museum internship in the Washington area or elsewhere. The student must pass a comprehensive examination based on course work and submit a research paper of publishable quality. In addition, the student must fulfill the tool requirement by passing a reading examination in an approved foreign language, an approved course in statistics or computer programming, or other approved courses.

201 **Introduction to Museum Studies** (3) Shapiro
An introduction to the field and literature of museum studies. Topics include: types and varieties of museums; governance and organization; financial, human, and physical resources; collections management; conservation principles and practices; programs, exhibition

education; interpretation; research, publications, evaluation; ethics and professionalism.

216 **Collections Management in the Natural History Museum** (3) — **Collier, Russell**
General principles of collections management—preservation, storage, maintenance, and documentation of natural science and anthropological specimens. Topics include storage hardware systems, environmental effects on collections, inventory control, registration systems, and data storage and retrieval. (Spring))

233 **Materials and Techniques of Art and Archaeological Artifacts: Inorganic Materials** (3) — Staff
A non-technical course for archaeologists, anthropologists, and art historians. Nature of the materials of objects of art and archaeology. Physical properties of the raw materials, techniques used to shape them into objects, and the final structure of the objects. (Fall)

234 **Materials and Techniques of Art and Archaeological Artifacts: Organic Materials** (3) — Staff
A non-technical course for archaeologists, anthropologists, and art historians. Nature of the materials of objects of art and archaeology. Physical properties of the raw organic materials, techniques used to shape them into objects, and the final structure of the objects. (Spring)

265 **The Small Museum: Selected Topics** (3)
Topics will vary. (Fall)

270 **Seminar: Museum Exhibiting** (3) — Mahoney
Selected museum exhibiting problems in the social and natural sciences, including methods and techniques of exhibition, problems of museum communication and education. Taught at the Smithsonian Institution. (Fall)

291 **Museum Internship** (3) — Shapiro
Individual work experience and/or research experience in museums of the Washington area and possibly elsewhere. Each student should make arrangements with the Director. Museum internships are supervised by one (or more) member(s) of the cooperating museum staff in the area of museum management, conservation, exhibiting, etc. May be repeated for credit. (Fall, spring, summer)

295 **Directed Research** (3) — Staff
Individual research on special topics of the museum field. Topics must be approved by the Director of Museum Studies. May be repeated for credit. (Fall, spring, summer)

297 **Special Topics in the Museum Field** (3) — Staff
Special topics may be organized by the Museum Studies staff or by request of six or more students.

Related Museum Studies Courses Offered by Other Departments

CONSERVATION

Art/Anth 292: *Introduction to Conservation*
Art/ Anth 293: *Preventive Conservation Techniques*
Art/Anth 212: *Advanced Conservation Techniques*
Anth 295: *Research*

ADMINISTRATION

Art 217–18: *Problems in Museum Work*

MUSEUM PROGRAMS

Art 209–10: *Exhibition and Display Design*
Anth 264: *Seminar: Museum Techniques*
Anth 291: *Anthropology in the Museum*
Educ 311: *Museum Audiences*

INTERNSHIPS

Art 201–2: *Museum Projects*
Art 271–72: *Museum Techniques*
Anth 290: *Advanced Museum Research*
AmCv 251: *Museum Research and Education*
Educ 312: *Internship in Museum Education*

MUSIC

Professors G. Steiner *(Chairman)*, R. Parris
Professorial Lecturer E. Meyers
Associate Professor N.A. Tilkens
Assistant Professor R.J. Guenther
Adjunct Assistant Professors M.C. Tolson *(Piano)*, C.J. Pickar *(Choral Activities)*, M. Garst *(Piano)*, J.E. White *(Voice)*
Assistant Professorial Lecturer B. Feinstein
Studio Instructors J. Albertson *(Guitar)*, F. Cohen *(Opera)*, M. Findley *(Violin)*, P. Fischer *(Flute)*, K. Fleming *(Cello)*, P. Gieseler *(Voice)*, E. Guenther *(Organ and Piano)*, N.M. Irvine *(Bass)*, S.K. Kim *(Piano)*, C.W. King *(Recorder)*, M. Kojian *(Violin)*, A. Lee *(Voice)*, L. Lipnick *(Bassoon)*, W.H. Mann *(Flute)*, M. McNabb *(Piano)*, R. Odmark *(French Horn)*, R.J. Pallansch *(Tuba)*, R. Parnas *(Violin and Viola)*, T. Perazzoli *(Flute)*, M. Peris *(Piano)*, S. Prussing *(Voice)*, D. Rorick *(Trumpet)*, B.R. Seidman *(Harp)*, M. Sislen *(Guitar)*, T. Wardlow *(Percussion)*, S. Wellman *(Voice)*, R. White *(Oboe)*, W.R. Wright *(Clarinet and Saxophone)*

***Bachelor of Arts with a major in music (departmental)*—The following requirements must be fulfilled:**

1. The general requirements as stated on pages 71–72, 79–85.
2. Prerequisite courses—Mus 2, 5–6, six hours of applied music lessons, a minimum of four semesters in music ensemble groups.
3. Required courses in related areas—12 hours of one foreign language **(French, German, or Italian recommended).**
4. Required courses in the major—Mus 101, 102, 103, 104, 131–32, 138, 151; six additional hours of applied music courses. Students preparing for graduate study or professional concentration in music may elect a further program of specialization in music literature, theory, or applied music. (Music theory majors must meet departmental requirements for proficiency in piano; applied music majors must perform a complete public recital or the equivalent in **major solo performances.)**

Bachelor of Music—Admission to the Bachelor of Music degree program requires demonstration of special advanced pre-admission training and aptitude. The 129-credit-hour program requires music courses as follows: Mus 2 and 9, 5–6, 101–2, 103–4, 131–32, 138–39, 151, 199; 6 hours of ensemble courses; 12 hours of other applied music courses; 15 hours of additional courses in the area of concentration; and 9 hours of electives. The general requirements con-

sist of 45 hours of non-music courses, including 6 hours each of English composition, humanities, social science, and natural science courses, and 12 hours of a foreign language.

Master of Arts in the field of musicology—Prerequisite: a bachelor's degree with a major in music, or an equivalent degree. Applicants from other institutions must present scores on the Advanced Music Test of the Graduate Record Examinations.

Required: the general requirements, pages 89–96. The program of study consists of 30 semester hours of course work including a thesis (six semester hours).

Master of Music in the field of music theory, music composition, conducting, or applied music—Prerequisite: a bachelor's degree with a major in music or an equivalent degree. Applicants from other institutions must present scores on the Advanced Music Test of the Graduate Record Examinations.

Required: the general requirements, pages 89–96. The required second- and third-group course work is as follows:

1. *In the field of music theory*—Thirty semester hours of course work including a thesis (six semester hours) demonstrating research ability in theoretical, creative, or analytical techniques.

2. *In the field of music composition*—Thirty semester hours of course work including a creative thesis of one composition in large form properly prepared for performance (chamber music, a symphonic form, or a choral work with orchestral accompaniment) including a theoretical, formal, and harmonic analysis of the work.

3. *In the field of conducting*—Thirty semester hours of course work including a thesis (six semester hours) demonstrating research ability in theoretical, creative, or analytical techniques. The requirements also include acceptable public conducting performances.

4. *In the field of applied music*—Thirty semester hours distributed as follows: (a) 12 semester hours of applied music in the area of concentration; (b) 12 semester hours of music theory and music history and literature courses; and (c) a thesis (six semester hours). The thesis consists of a public recital and performance before a designated committee (such a recital and performance must be representative of an extensive and well-rounded repertory, performed on a professionally accepted artistic level), and delivery of an historical and analytical lecture on the musical content of the program; demonstrated leadership in an ensemble performance (opera or oratorio for voice); and a written report on some approved theoretical area related to the student's concentration.

Bachelor of Arts in Education and Human Development with a teaching field in music—Prerequisite: the education curriculum, pages 111–12.

Required: the music option and professional courses listed on page 115.

MUSIC THEORY, HISTORY, AND LITERATURE

First Group

1 Elements of Music Theory (3) Guenther, Parris
Notation, scales, keys, intervals, terms, rhythms, and chord structure. (Fall and spring)

2 Ear-Training I (3) Pickar
Melodic and harmonic dictation, ear-training, sight-singing, elementary keyboard harmony. (Fall)

3 Introduction to Musical Understanding (3) Steiner, Tilkens
Introductory history of musical styles, related to listening; study of music materials and media. (Fall and spring)

4 Survey of Music Literature (3) Tilkens
Introductory study of musical forms, structures, and textures; aura. analysis of selected literature. (Spring)

5–6 Harmony (3–3) Parris
Triads, inversions; chord analysis, construction, and progression part-writing, modulations, altered chords. Prerequisite: Mus 1 o: satisfactory passing of placement examination. (Fall and spring)

7 Music of Nonwestern Cultures (3) Tilkens
Introductory survey of the basic systems and styles of music in the major cultures of the Eastern Hemisphere and Africa.

8 History of Jazz (3) Staff
Introduction to the styles, composers, and performers of jazz music from its origins to the present. (Summer)

9 Ear-Training II (3) Pickar
(Spring)

Second Group

101–2 History of Music I (3–3) Tilkens
Development of music in the Western world from the early Christian era through the Baroque. (Academic year)

103–4 History of Music II (3–3) Tilkens
Development of Western music from the Classic period to the present. (Academic year)

109 Orchestra Literature (3) Steiner
Survey of the history and styles of orchestra literature, analysis o: representative works.

110 Chamber Music Literature (3) Steiner
Survey of the history and styles of chamber music literature, analysis of representative works.

121 The Opera (3) Feinstein
Survey of the history and styles of opera, analysis of representative works.

125 Keyboard Music Literature (3) Tilkens
Survey of the history, style, and major content of the keyboard literature from the 16th century to the present.

131–32 Advanced Theory (3–3) Parris
Practice in 18th-century contrapuntal writing and analysis, chorale preludes, inventions, and fugues. Prerequisite: Mus 5-6 or equivalent. (Academic year)

133–34 Composition (3–3) Parris
(Academic year)

135 Counterpoint (3) Parris
Study and practice of 16th-century contrapuntal techniques. (Spring)

137 Orchestration (3) Parris
Instrumental scoring. (Spring)

138–39 Form and Analysis (3–3) Parris
Analysis of musical forms in representative musical literature (Academic year)

151 Conducting (3) Steiner
Technique of conducting, score reading, rehearsal procedures, analysis, and interpretation of selected musical literature; practice in conducting. (Fall)

160–61 **Electronic Music** (3–3) Meyers
Tape and electronic techniques, synthesizer use, and acoustical principles. (Academic year)

173 **Pedagogy** (3) Staff
Principles, materials, and methods of teaching in a selected area. See *Schedule of Classes* for specific area. (Spring)

199 **Independent Research** (3) Staff
Under the guidance of an assigned instructor. Open only to qualified music majors. May be repeated for credit. (Fall and spring)

Third Group

203 **Bibliography and Research Methodology** (3) Guenther
(Fall)

205 **Music of the Baroque Period** (3) Tilkens
Study of the musical styles, techniques, and literature from 1600 to 1750.

206 **Music of the Classic Period** (3) Guenther
Study of styles, techniques, and literature from the 18th-century schools through Haydn, Mozart, and Beethoven.

207 **Music of the Romantic Period** (3) Guenther
Study of the musical styles, backgrounds, and literature from Schubert through the 19th century.

208 **Music of the 20th Century** (3) Guenther
The principal schools, techniques, developments, and trends of the 20th century. (Spring)

231–32 **Composition** (3–3) Parris
May be repeated for credit. (Academic year)

234 **Seminar: Performance Practices in Selected Areas** (3) Staff

237 **Seminar: Analytical Studies in Music Theory** (3) Guenther, Parris
(Fall and spring)

238 **Seminar: Analytical Studies in Music History** (3) Tilkens, Guenther
Fall: Handel; spring: Mahler.

239 **Independent Research** (3) Staff

251–52 **Advanced Conducting** (3–3) Steiner
(Academic year)

299–300 **Thesis Research** (3–3) Staff
(Fall and spring)

APPLIED MUSIC

All applied music courses are offered both fall and spring, and may be repeated for credit.

Mus 51, 52, 53, 54, 55 and 153 do not include individual lessons and do not require a supplementary fee. All other applied music courses include individual lessons and require a supplementary fee, as follows:

1. One-semester-hour courses: individual lessons of one-half hour a week, supplementary fee, $75.
2. Two- or three-semester-hour courses: individual lessons of one hour a week, supplementary fee, $150.

Supplementary fees for applied music courses are nonrefundable after the first three weeks of the fall and spring semesters. Supplementary fees are different for courses offered during the summer sessions. Consult the Music Department for details.

The supplementary fee is waived for graduate degree candidates in music and full-time undergraduate music majors.

First Group

Required practice: three hours a week for one-semester-hour courses and six hours a week for two-semester-hour courses.

11 Piano (1) — Staff
12 Piano (2) — Staff
13 Voice (1) — Staff
14 Voice (2) — E. Guenther
15 Organ (1) — Staff
16 Organ (2) — Staff
17 Violin (1) — Staff
18 Violin (2) — Parnas
19 Classical Guitar (1) — Fleming
20 Classical Guitar (2) — Irvine
21 Viola (1) — Staff
22 Viola (2) — King
23 Cello (1) — R. White
24 Cello (2) — Wright
25 Bass (1) — Wright
26 Bass (2) — Lipnick
27 Flute (1) — Odmark
28 Flute (2) — Rorick
29 Recorder (1) — R. Guenther
30 Recorder (2) — Wardlow
31 Oboe (1) — Seidman
32 Oboe (2) — Pallansch
33 Clarinet (1) — Steiner
34 Clarinet (2)
35 Saxophone (1)
36 Saxophone (2)
37 Bassoon (1)
38 Bassoon (2)
39 French Horn (1)
40 French Horn (2)
41 Trumpet (1)
42 Trumpet (2)
43 Trombone (1)
44 Trombone (2)
45 Percussion (1)
46 Percussion (2)
47 Harp (1)
48 Harp (2)
49 Tuba (1)
50 Tuba (2)

51 Orchestra (1) — Steiner
Preparation and performance of orchestral literature. Prerequisite: audition before director. (Fall and spring)

52 Instrumental Ensemble (1) — Pickar
Chamber ensemble groups approved by audition. (Fall and spring)

53 Chorus (1)
Preparation and performance of choral literature. Prerequisite: audition before director. (Fall and spring)

54 Chamber Choir (1) Pickar
Small vocal groups and chorus participation. Prerequisite: audition before director. (Fall and spring)

55 Band (1) Wright
Concert band, stage band and brass ensemble. (Fall and spring)

Second Group

Departmental prerequisite: audition to meet departmental requirements.
Required practice: six hours a week for one-semester-hour courses and 12 hours a week for three-semester-hour courses. In addition, three-semester-hour courses include master performance classes and recital preparation.

111 Piano (1) Staff
112 Piano (3)
113 Voice (1) Staff
114 Voice (3)
115 Organ (1) Staff
116 Organ (3)
117 Orchestral Instrument (1) Staff
118 Orchestral Instrument (3)
119 Classical Guitar (1) Staff
120 Classical Guitar (3)
153 Opera Workshop (1) Staff
Preparation and dramatic performance of operatic literature. Prerequisite: audition before director. (Fall and spring)

Third Group

All courses include supervised ensemble preparation and required concert solo performances.

211 Piano (3)
213 Voice (3)
215 Organ (3)
217 Orchestral Instrument (3)

PATHOLOGY—GRADUATE PROGRAM

Professors H. Sidransky *(Chairman)*, F.N. Miller, S. Bloom
Associate Professors S.G. Kent, B.C. Zook *(Comparative)*, Y. Al-Doory, C.T. Garrett
Assistant Professor J.M. Orenstein

Programs of study leading to the degree of *Associate in Science (Medical Laboratory Technique)* are described in the *School of Medicine and Health Sciences Bulletin.*

Doctor of Philosophy *in the field of pathology*—Prerequisite: one of the following degrees from a recognized professional school: Doctor of Medicine (M.D.), Doctor of Veterinary Medicine (D.V.M.), or Doctor of Dentistry (D.D.S.). In exceptional cases, applicants with other backgrounds in the life sciences may be accepted.

Required: the general requirements, pages 89–91, 96–99, including 48 semester hours of approved graduate course work. One year of experience in pathology at the University Hospital, equivalent to Path 283, may be counted for a maximum of 24 semester hours of graduate course work. Other experience

must satisfy the eligibility requirements of the appropriate national certifying body, i.e., the American Board of Pathology in the case of the M.D., the American College of Veterinary Pathologists in the case of the D.V.M., and the American Board of Oral Pathology in the case of the D.D.S.

Research fields: comparative pathology, human pathology, ophthalmic pathology, veterinary pathology, biochemical pathology, cardiovascular pathology, and nutritional deficiency pathology.

203–4 Pathology (4–4) Staff
General introduction to concepts of disease. Pathology of organ systems; correlation with symptoms and physical signs. Gross and microscopic study of diseased tissues. Case studies. Limited enrollment. Prerequisite to Path 203: Anat 202, 203, 204, 205; or equivalent. Prerequisite to Path 204: Path 203. (Academic year)

220 Medical Mycology (2 or 4) Al-Doory
Lecture and laboratory course covering pathogenic fungi, mycotic diseases, and their clinical aspects. Laboratory fee, $20. (Fall)

222 Opportunistic Mycoses (2) Al-Doory
Study of the opportunistic fungal infections and their serological, clinical, and therapeutic aspects. Emphasis on identification of fungi and evaluation of laboratory findings. (Spring)

256 Pathology of Infectious Diseases (3) Abraham*
Correlation of clinical, physiologic, immunologic, and pathologic mechanisms determining the course and morphological changes which occur in infections. Analysis of human case material and review of assigned selected readings. Prerequisite: Micr 211 and Path 203.

257 Transmission Electron Microscopy in Pathologic Diagnosis (3) Orenstein, Abraham
Techniques for the examination and interpretation of ultrastructural changes associated with human disease states. Emphasis on transmission electron microscopy as a diagnostic tool. Prerequisite: Path 203, 204; Anat 260, 261.

258 Organ System Pathology (5) Bloom
Gross and microscopic study of human pathologic material reflecting major diseases of specific organ systems. The organ systems studied will be rotated annually depending on demand. Organ systems to be covered include cardiovascular, digestive, nervous, renal, reproductive, and respiratory. Prerequisite: Path 203, 204, and permission of instructor. (Fall and spring)

276 Seminar in Experimental Pathology (1) Staff
Presentations on current topics in experimental pathology. (Fall and spring)

283 Anatomic Pathology Clerkship (arr.) Staff
Necropsy and surgical pathology service. Prerequisite: Path 203–4 or equivalent. Five semester hours of credit for each four-week period. Students may receive up to 30 semester hours of credit for six months full-time. Open to limited number of graduate students, with permission.

286 Perinatal Pathology (arr.) Kent
Course will focus on the important disorders that may beset the human fetus and the newborn infant. Emphasis on the role of placental abnormalities. Prerequisite: Path 203 or equivalent. (Spring)

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* Andreas Andrew Abraham is Associate Professor of Pathology at the G.W.U. School of Medicine and Health Sciences.

295 **Comparative Pathology** (arr.) Zook, Jones,* Montalit
Participation in veterinary pathology service, including studies of domestic, wild, and laboratory animals. Review of training materials and participation in training sessions. Graduate students receive five semester hours of credit for each four-week full-time period. Prerequisite: Path 203–4.

299–300 **Thesis Research** (3–3) **Staff**
(Fall and spring)

398 **Advanced Reading and Research** (arr.) **Staff**
Limited to students preparing for the Doctor of Philosophy general examination. May be repeated for credit. (Fall and spring)

399 **Dissertation Research** (arr.) **Staff**
Limited to Doctor of Philosophy candidates. May be repeated for credit. (Fall and spring)

PHARMACOLOGY

Professors H.G. Mandel *(Chairman)*, V.H. Cohn, P. Mazel, J.A. Straw, P. Klubes, F.P. Abramson
Professorial Lecturer J. Axelrod
Associate Professor R.J. Anderson
Assistant Professors B.L. Bean, N.A. Brown

Master of Science in the field of pharmacology—Prerequisite: a Bachelor of Arts or Bachelor of Science degree. The undergraduate program must have included the following courses, or equivalent: BiSc 11–12; Phys 1, 2; Math 31, 32; Chem 11–12, 22, 151–52, 153–54. A course in physical chemistry is also recommended.

Required: the general requirements, pages 89–96, including Bioc 221–22; Phyl 201, 212; Phar 203, 205, 299–300.

Doctor of Philosophy in the field of pharmacology—Required: the general requirements, pages 89–91, 96–99.

Research *fields:* biochemical pharmacology and toxicology, cancer chemotherapy, developmental pharmacology and toxicology, endocrine pharmacology, molecular pharmacology, neuropharmacology, neurotoxicology, genetic toxicology, cardiovascular pharmacology, pharmacokinetics, pharmacology of drug abuse, and physiological disposition of drugs.

Second Group

114 **Drugs and the Consumer** (3) Cohn and Staff
General concepts of drug action in the body. Action mechanism of some specific prescription and nonprescription drugs, including contraceptives; tranquilizers and sleep-inducing drugs; hayfever, headache, and cold remedies; analgesics; antibiotics; vitamins. Issues related to development and marketing of drugs, drug safety, drug advertising, generic versus tradename drugs, drug use in sports, drug use during pregnancy, smoking and health. No science prerequisites. Limited enrollment. (Fall)

115 **Nonmedical Use of Licit and Illicit Drugs** (3) Cohn
Psychological and sociological bases of recreational and other nonmedical use of drugs, pharmacological and toxicological aspects of

* Sydney Robert Jones is Adjunct Associate Professor of Pathology (Comparative Pathology) at the G.W.U. School of Medicine and Health Sciences.
† Richard J. Montali is Adjunct Associate Professor of Pathology (Comparative Pathology) at the G.W.U. School of Medicine and Health Sciences.

drug action on both the brain and peripheral organ systems, legal and societal implications of and reactions to the nonmedical use of drugs, prevention and treatment of drug dependence. Lectures and discussions on alcohol, narcotics, central nervous system stimulants and depressants, marijuana, hallucinogenic and psychedelic drugs. There are no science prerequisites. (Spring)

158 **Drugs and Their Actions** (2) Klubes and Staff
Introductory pharmacology course. Drugs, the basis of their therapeutic and toxic actions and their fate in the body. Admission by permission of the instructor. (Spring)

Third Group

203 **Fundamental Principles of Pharmacology and Toxicology** (3) Cohn and Staff
Basic principles of pharmacology, including drug receptor interactions, structure activity relationships, pharmacokinetics, membrane phenomena, cellular control mechanisms, drug toxicity. Admission by permission of the instructor. (Fall)

205 **Pharmacology** (8) Cohn and Staff
Lectures, laboratory, conferences on interaction of drugs and biological systems as a basis of rational disease therapy. Prerequisite: Phar 203, courses in biochemistry and physiology, or approval of department. (Fall)

207 **Cardiovascular Pharmacology** (2) Bean and Staff
Physiology and pharmacology of cardiovascular diseases, hypertension, heart failure, coronary artery disease, arrhythmia. Mechanism of action of drugs used in the treatment of cardiovascular diseases. Prerequisite: Phyl 201 and Phar 201, 203, or 205. (Spring)

215 **Adolescent Drug Abuse** (3) Cohn and Staff
Offered off campus primarily for teachers, counselors, and school administrators. Multidisciplinary lectures and discussions concerning the physiological and psychological effects of narcotics, central nervous system stimulants and depressants, alcohol, and hallucinogenic and psychedelic drugs; psychosocial factors leading to adolescent drug abuse; legal implications of drug abuse; prevention, control, and treatment of drug abuse. (Fall and spring)

220 **Molecular Events in Toxic Actions** (2) Brown and Staff
Metabolism of xenobiotics to cytotoxic products. Environmental and genetic factors influencing toxic actions. Molecular mechanisms of toxicity. Prerequisite: Phar 203. (Spring)

222 **Genetic Toxicology** (2) Williams* and Staff
The action of chemicals and radiation in the induction of DNA damage and repair *in vitro* and *in vivo*, and the sequelae of these processes in cells and mammals. DNA repair mechanisms, mammalian cell toxicity, mutagenesis, and carcinogenesis. Prerequisite: Bioc 221–22. (Fall)

224 **Developmental Toxicology** (2) Brown
The effects of exogenous agents on the processes of reproduction and development and their mechanisms of action. Toxic effects on the gametes, embryo, fetus, and neonate. Prerequisite or concurrent registration: Phar 203, 205. (Spring)

226 **Neurotoxicology** (2) Anderson
Mechanisms by which chemicals produce toxic effects on nervous

* Jerry Randall Williams is Research Professor of Radiology and of Pharmacology in the G.W.U. School of Medicine and Health Sciences.

tissue at the subcellular, systemic, and behavioral levels. Effects of chronic and acute exposure. Prerequisite or concurrent registration: Phar 203, 205. (Spring, odd years)

230 **Special Topics in Toxicology** (arr.) Staff
Selected aspects of toxicology. Content differs each time the course is offered. May be repeated for credit. (Fall and spring)

254 **Frontiers in Pharmacology** (1) Straw and Staff
Recent advances and research in pharmacology. Presentations by laboratory scientists from neighboring institutions. (Spring)

256 **Molecular Pharmacology** (2 or 3) Mandel and Staff
Current theory on drug actions, especially chemotherapeutic agents, at molecular level. Effect of drugs on biosynthetic processes of the cell with respect to DNA, messenger RNA, transfer RNA, ribosomes, protein, cell wall, and intermediary metabolites. Factors which alter action of drugs, such as drug interactions and resistance. (Spring)

258 **Cancer Chemotherapy** (1) Mandel and Staff
Mechanisms by which drugs inhibit the growth of tumor cells. (Spring, even years)

259 **Readings: Cancer Chemotherapy** (2) Klubes and Staff
Selected readings and discussion of recent advances in cancer chemotherapy research. Prerequisite: Phar 201 or 205. (Spring, odd years)

260 **Endocrine Pharmacology** (1) Staff
Lectures and seminars on recent advances in the pharmacology and mechanisms of action of various hormones. (Spring, odd years)

269 **Pharmacology Seminar** (1) Straw and Staff
Recent advances in pharmacology. Content differs each time the course is offered; may be repeated once for credit. (Fall and spring)

272 **Physiological Disposition of Drugs** (3) Cohn
Fate of drugs in biological tissue. Absorption, distribution, chemical alteration, excretion of drugs; physical, chemical, and biological factors affecting these processes. Prerequisite: Phar 205 or permission of the instructor. (Spring, even years)

273 **Pharmacokinetics: Principles and Applications** (2) Abramson and Staff
A description of compartmental and physiological models of drug disposition. Problem-solving to obtain rate constants, organ clearances, etc., from experimental data. Examples of drug disposition exemplifying various pharmacokinetic approaches. (Spring)

275–76 **Advanced Topics in Pharmacology and Toxicology I-II** (1–1) Anderson and Staff
Lectures and seminars on advances in mechanisms of drug action, pharmacology of new drugs, theoretical aspects of pharmacology, laboratory techniques. (Alternate academic years)

277–78 **Advanced Topics in Pharmacology and Toxicology III-IV** (1–1) Anderson and Staff
Continuation of Phar 275–76. (Alternate academic years)

279 **Special Topics in Pharmacology** (arr.) Staff
Selected aspects of drug action. Content differs each time the course is offered; may be repeated once for credit. (Fall and spring)

280 **Neuropharmacology** (2) Anderson and Staff
Fundamental principles. Electrophysiological and biochemical techniques. Neurotransmitters and their pathways in the central nervous system. Drug effects on neurotransmitter pathways. Biochemical

basis of mental disease. Prerequisite: Phar 205 or equivalent. (Spring, even years)

295 **Reading and Research** (arr.) **Staff**
Independent study for students preparing for the Master of Science degree. May be repeated for credit. (Fall and spring)

299–300 **Thesis Research** (3–3) **Staff**
(Fall and spring)

Fourth Group

398 **Advanced Reading and Research** (arr.) **Staff**
Limited to students preparing for the Doctor of Philosophy general examination. May be repeated for credit. (Fall and spring)

399 **Dissertation Research** (arr.) **Staff**
Limited to Doctor of Philosophy candidates. May be repeated for credit. (Fall and spring)

PHILOSOPHY

University Professor P.J. Caws
Professors T.Z. Lavine, R.H. Schlagel *(Chairman)*, R.S. French
Associate Professor W.B. Griffith
Assistant Professors R.P. Churchill, J.D. Moreno

Bachelor of Arts with a major in philosophy (departmental)—The following requirements must be fulfilled:

1. The general requirements as stated on pages 71–72, 79–85. (Students should consult the departmental advisor regarding courses to be taken in satisfying the requirements for meaningful initiation into the social sciences and the natural and mathematical sciences.)

2. Required courses in related areas—six semester hours of literature courses selected from Chinese, Classics, English, French, German, Italian, Slavic, or Spanish (Clas 71, 72, or Engl 191-92 recommended); six hours selected from art history, music history, or religion; six hours in history (Hist 39–40 recommended).

3. Required courses in the major—a minimum of 30 semester hours, including Phil 111, 112, 113; 6 semester hours selected from Phil 121, 151, 152; 6 semester hours selected from Phil 131, 132, 162; 6 semester hours selected from Phil 172, 192, 193; plus one additional course recommended to be selected from the graduate seminars in philosophy.

For students expecting to continue in graduate school, it is recommended that they include in their program of study 12 semester hours of introductory French, German, or Greek language courses.

Minor in philosophy—Required: a minimum of 18 semester hours, including 6 hours selected from Phil 111, 112, 113 without Phil 50, or 3 hours selected from the same group of courses with Phil 50, plus 12 hours of elective philosophy courses.

Master of Arts in Special Studies with an area of concentration in philosophy and social policy—An interdisciplinary program which brings the normative, historical, and analytical-logical skills of philosophical inquiry to bear upon contemporary problems of social policy. Prerequisite: a bachelor's degree from an accredited college or university. Students are expected to have completed the prerequisites to graduate courses.

Required: the general requirements, pages 89–96. Two options are available at the discretion of the faculty: (1) a minimum of 24 semester hours of approved graduate course work plus the successful completion of a thesis, or (2) a mini-

mum of 36 semester hours of graduate course work which does not include a thesis. All students are required to take four courses selected from the following: Phil 198, 231, 242, 271, 272. Phil 205 is open to all students; it is required of those with insufficient background in philosophy, as determined by the department. Phil 299–300 is required for students electing to write a thesis. The remainder of the course work in both options must include a majority of approved courses in the arts and sciences. Other courses may be selected from the School of Education and Human Development, School of Government and Business Administration, and School of Public and International Affairs. Each candidate must pass a Master's Comprehensive Examination based on the particular interdisciplinary composition of the student's program of study. Prospective candidates should consult Professor Roderick French, director of the program.

First Group

41 Roots of the Western Tradition (3) Staff
Same as Clas/Engl Hist Rel 41. Basic ideas of western thought from early Greek, Roman, Judaic, and Christian traditions. Representative readings in drama, epic, historical writings, oratory, creation stories, scriptural traditions, philosophy, and spiritual autobiography. To be taken in conjunction with Engl 13. (Spring)

45 Introduction to Logic (3) Churchill
Deduction, induction, and legal reasoning; emphasis on recognition of fallacies and practical applications of logic. (Spring)

50 Introduction to Philosophy (3) Staff
Readings from major philosophers and study of philosophic positions from Plato to Sartre. (Fall and spring)

71 Philosophy and Literature (3) Lavine
Philosophical foundations of psychoanalytical psychiatry, existentialism, and Marxism and their expression in literature, e.g., in the works of Mann, Kafka, Camus, Sartre, Hesse, Gide, and Koestler. (Spring)

*91 **East Asia—Past and Present** (3) Johnson and Associated Faculty
An interdisciplinary course, introducing the student to a comprehensive and integrated understanding of the civilization and present problems of East Asia.

Second Group

111 History of Ancient Philosophy (3) Churchill
History of Western philosophy from early Greece to the early Middle ages. (Fall)

112 History of Modern Philosophy (3) Churchill
History of Western philosophy of the 17th and 18th centuries (Descartes to Kant). (Spring)

113 19th-Century Philosophy (3) Lavine
European philosophy from the Enlightenment and Kant to German Romanticism, Fichte, Hegel, Kierkegaard, Schopenhauer, and Nietzsche. (Fall)

121 Symbolic Logic (3) Griffith
Systematic study of the principles of valid inference with attention to the development of skill in logical analysis and evaluation of arguments, and to the elementary theory of formal systems. (Fall)

* An interdepartmental course offered by the Philosophy, East Asian Languages and Literatures, Economics, Geography and Regional Science, History, Political Science, and Religion Departments.

127 Theories of History (3) Lavine
Major philosophies of history: Judeo-Christian, linear progressive, historicist, Hegelian-Marxian dialectical, cyclical (Vico, Spengler, Toynbee), and social-scientific (Comte, Weber). Contemporary problems of historical knowledge. Same as Hist 127. (Fall)

131 Ethics (3) Griffith
Main types of ethical theory: egoistic, utilitarian, self-realization, conscience, existentialism. Applications to contemporary problems. (Spring)

132 Social Philosophy (3) Lavine
Social philosophies from Locke to contemporary theorists. (Spring)

133 Philosophy, Nonviolence, and the Problem of War (3) Churchill
Problems of war in relation to morality; theories of human aggression and violence; nonviolence and pacificism as alternatives to war; doctrine of just war. (Summer)

142 Philosophy of Law (3) Churchill
Systematic examination of fundamental concepts of law and jurisprudence; special emphasis on the relationship between law and morality. (Fall)

151 Myth, Science, and the Modern Mind (3) Schlagel
An overview of the growth of scientific rationalism from its origin in mythopoetic thought to the present, with emphasis on conceptual and methodological developments. Comparison of the cosmologies (Fall)
frameworks of Aristotle, Newton, and contemporary physics.

152 Knowledge, Truth, and Reality (3) Schlagel
Inquiry into the basis and structure of knowledge, the problem of perception and independent reality, the role of language in knowledge, and the meaning and criteria of truth. (Spring)

162 Aesthetics (3) Moreno
Nature of aesthetic experience as related to artistic appreciation, criticism, and creation; artistic representation as a kind of systematic symbolization. (Spring)

172 American Philosophy (3) Moreno
Philosophies of Peirce, Royce, James, Dewey, and Santayana as representatives of American thought. (Fall)

192 Contemporary Philosophy: Analytical (3) Moreno
The two dominant movements of recent Anglo-American philosophy, logical positivism and British ordinary language philosophy, as represented by Russell, G. E. Moore, Wittgenstein, Ryle, Ayer, etc. (Fall)

193 Contemporary Philosophy: Phenomenological (3) Griffith
Turn-of-the-century intellectual crisis and Husserl's phenomenological movement; the phenomenological existentialism of Heidegger and Sartre; existential Marxism in Sartre and Merleau-Ponty; Hermeneutics of Ricoeur and Gadamer. (Spring)

197 Contemporary Ideologies and Utopias (3) Lavine
A philosophic analysis of recent ideologies and utopias in Europe, the United States, and Asia: the sociological, psychological, political, and intellectual origins of ideologies; their theoretical structure and their practical functions; the relation of ideologies to social change; the significance of the diffusion of ideologies to other cultures; ideologies and the problem of value-relativity. (Fall)

198 Philosophy of the Social Sciences (3) Lavine
Philosophic issues relating to theory, methodology, and applications

of the social sciences. Analysis of one major contemporary social scientific project. (Spring)

199 **Readings and Research** (3) Staff
(Fall and spring)

Third Group

201–2 **Readings and Research** (3–3) Staff
Advanced readings and reports. Investigation of special problems. (Academic year)

205 **Selected Schools and Problems** (3) Staff
An advanced review of the rise of modern empiricism, idealism, and pragmatism, with particular attention to controversies regarding problems of method, epistemology, and social and political theory. Recommended for graduate students who have majored in fields other than philosophy. (Fall)

216 **Seminar: Kant** (3) Schlagel
Critique of Pure Reason. (Fall)

221 **Seminar: Logic of Social Choice** (3) Griffith
Formal analysis of contrasting arguments justifying social choices: the appeal to welfare optimization, or to fairness of the social decision procedure. Special focus on Arrow's Impossibility Theorem. (Spring)

231 **Ethics and Economic Policy: Justice and Equality** (3) Griffith
Economic policy viewed from the perspectives of ethical and economic theories with special focus upon the issue of income distribution in the United States. (Fall)

235 **Ethics and Business** (3) Griffith
Business practice in the light of ethical theory: corporate power and citizenship, advertising approaches, competitive practices, white collar crime. Cases and incidents. (Spring)

242 **Philosophy, Law, and Social Reform** (3) Churchill
A philosophical investigation of moral and legal rights in the American tradition, the importance of claims of right and entitlement in policy issues, and the ways legal institutions define specific rights by limiting or giving effect to our duties and liberties. (Spring)

251 **Seminar: Philosophy of Science** (3) Schlagel
Selected topics. (Spring)

252 **Seminar: Epistemology** (3) Schlagel
Critical examination of selected problems or theories of knowledge.

271 **Mankind and Nature in Public Policy** (3) French
Relation of philosophical conceptions of man and nature to national policies of growth and development in selected periods of American history. (Fall)

272 **American Philosophy and Mental Health Policy** (3) Moreno
Analysis and application of philosophical modalities to conceptual problems in mental health care as related to the construction of a social policy. (Spring)

299–300 **Thesis Research** (3–3) Staff

PHYSICAL SCIENCE

See Chemistry.

PHYSICS

Professors H.H. Hobbs, J. Eisenstein, O. Bergmann, A.J. Zuchelli, F. Prats *(Chairman)*, D.R. Lehman
Adjunct Professor L.C. Maximon
Associate Professors W.C. Parke, N.K. Khatcheressian, M.F. Taragin, E.P. Harper
Associate Professorial Lecturers J.J. Coyne, N. Khelil, R. Eaton III, M.T. Shams, W.D. Lee
Assistant Professor J.R. Peverley
Assistant Professorial Lecturers M.I. Haftel, J.T. Broach
Lecturer M. Lutzky

Bachelor of Arts with a major in physics (departmental)—The following requirements must be fulfilled:

1. The general requirements as stated on pages 71–72, 79–85.
2. Prerequisite courses—Phys 13, 14, 15, 16; Chem 11–12; Math 31, 32, 33.
3. Required courses in related area—Stat 97 or EE 51; Math 111–12.
4. Required courses in the major—Phys 151–52, 161, 162, 163, 164, 165–66, 167, 168, 195.

Bachelor of Science with a major in physics (departmental)—The following requirements must be fulfilled:

1. The general requirements as stated on pages 71–72, 79–85.
2. Prerequisite courses—Phys 1, 2, 14, 15, 16; Chem 11–12; Math 31, 32, 33.
3. Required courses in related area—Stat 197 or CSci 100; Math 111–12.
4. Required courses in the major—Phys 106, 127–28, 151–52, 163, 164, 195–96 plus one of the following: Phys 161, 165, 167.

Minor in physics—Required: Phys 3, 14, 15, 16; Phys 163 and 164 or approved substitutes from 100-level physics courses.

Master of Arts in the field of physics—Prerequisite: a bachelor's degree with a major in physics at this University, or an equivalent degree.

1. The Master's degree program *with* thesis—Required: the general requirements, pages 89–96, and 30 semester hours of course work in physics, including Phys 211, 212, 213–14, 221–22, 233, 299–300; plus one of the following: Phys 224, 225–26, 231, 243, 244.

2. The Master's degree program *without* thesis—Required: the general requirements, pages 89–96, and 36 semester hours of course work in physics and mathematics including Phys 211, 212, 213–14, 221–22, 233; plus one of the following: Phys 224, 225–26, 231, 243, 244.

A reading knowledge of a foreign language, or the successful completion of Stat 197, with a grade of *A* or *B* is a tool requirement.

Doctor of Philosophy in the field of physics—Required: the general requirements, pages 89–91, 96–99, and the successful completion of one of the two following tool requirement options: (a) two foreign language reading examinations or (b) one foreign language reading examination and completion of Stat 197 with a grade of *A* or *B*.

Research field: nuclear physics: theoretical studies on the structure, electromagnetic interactions and scattering of few-body systems at low and intermediate energies.

Bachelor of Arts in Education and Human Development with a teaching field in physics—Prerequisite: the education curriculum, pages 111–12.

Required: the physics option and the professional courses listed on page 115.

Departmental prerequisite for second-group courses—Bachelor of Arts: Phys 13, 14, 15, 16; three semesters of calculus; and consent of a departmental advisor. Bachelor of Science: Phys 1, 2, 14, 15, 16; three semesters of calculus; and consent of a departmental advisor. Phys 106, 127, and 151 are exempt from these prerequisites.

Undergraduate departmental advisors: W. Parke, N. Khatcheressian, M. Taragin
Graduate departmental advisors: D. Lehman, F. Prats

ASTRONOMY

First Group

9–10 Introduction to Astronomy (3–3) Hobbs
Lecture (2 hours), recitation (1 hour), laboratory (2 hours). Classical through modern astronomy with introduction to basic principles underlying astronomical systems and observations. Primarily for nonscience majors. Laboratory fee, $15 per semester. (Academic year)

11–12 Introduction to Astronomy (2–2) Hobbs
Same as Phys 9-10 without the laboratory. (Academic year)

Second Group

121 Modern Cosmology (3) Hobbs
(Formerly Phys 21)
Nonmathematical treatment of cosmology and related subjects from astronomy and physics. Quasars, peculiar galaxies, pulsars, black holes, antimatter, etc. Prerequisite: Phys 10 or 12.

PHYSICS

First Group

1 General Physics I (4) Parke, Peverley
Lecture (2 hours), recitation (1 hour), laboratory (2½ hours). Development of conceptual principles underlying modern physical knowledge; basics of mechanics, heat, and light, including the classical concepts of energy, momentum, heat, temperature, entropy, and optics. Prerequisite: two years of college preparatory mathematics or concurrent registration in Math 6. Laboratory fee, $20.

2 General Physics II (4) Zuchelli, Eisenstein
Lecture (2 hours), recitation (1 hour), laboratory (2½ hours). Topics focusing upon present understanding of the physical universe and character of the atomic and subatomic worlds. Includes considerations of electric and magnetic phenomena, relativity theory, wave-particle duality, quantum theory, nuclei, and subnuclear particles. Prerequisite: Phys 1 or equivalent. Laboratory fee, $20.

3 General Physics I (3) Parke, Peverley
Same as Phys 1 without laboratory. This course may not be taken by students who have completed, or are enrolled in or plan to enroll in Phys 1.

4 General Physics II (3) Zuchelli, Eisenstein
Same as Phys 2 without laboratory. This course may not be taken by students who have completed, or are enrolled in or plan to enroll in Phys 2.

13 General Physics for Engineering and Applied Science (3) Peverley
Development of basic principles of classical mechanics including statics and dynamics of rigid bodies and simple fluids, wave motion,

geometrical and physical optics. Prerequisite: two years of college preparatory mathematics or concurrent registration in Math 6.

14 **Mechanics and Thermal Physics** (3) Khatcheressian
Lecture (2 hours), recitation and laboratory (2 hours). Physical principles of mechanics and thermal physics utilizing tools of calculus. Topics emphasized are vector calculus, equilibrium phenomena, kinematics, Newton's Laws, conservation of mass, momentum and energy, rotational motion, small vibrations, thermometry, macroscopic and microscopic properties of ideal gases, the laws of thermodynamics, thermal properties of solids and liquids. Prerequisite: Phys 3 or equivalent; Math 31. Laboratory fee, $20.

15 **Electricity and Magnetism** (3) Taragin, Peverley
Lecture (2 hours), recitation and laboratory (2 hours). Introductory aspects of electromagnetic theory. Topics include static electric fields, Coulomb's Law, Gauss' Law, electrical potential, capacitance and dielectrics, electric current and resistance, Ampere's Law, Faraday's Law, Maxwell's equations in integral form, electromagnetic waves. Prerequisite: Phys 3 or equivalent; Math 31. Laboratory fee, $20.

16 **Modern Physics** (3) Lehman
Lecture (2 hours), recitation and laboratory (2 hours). Elementary approach to the basic principles of quantum theory. Topics include wave-particle duality, the hydrogen atom, Pauli's exclusion principle, x-ray spectra, the atomic nucleus, radioactivity, nuclear reactions, statistical distribution laws, applications to molecular and solid state physics. Prerequisite: Phys 14, 15; Math 32. Laboratory fee, $20.

Second Group

106 **Energy and the Environment** (3) Lehman
(Formerly Phys 6)
Consideration of energy resources and their utilizational impact on the environment from a physical viewpoint. Topics include: the demand for energy, the cost of energy, nuclear fission-radiation hazard to humans, pollution due to energy sources, transportation of energy and waste, and energy converters. Prerequisite: high school algebra.

127–28 **Physics in the Life Sciences** (3–3) Parke
(Formerly Phys 27–28)
Principles of physics applied to biological systems and to medical instrumentation, including ultrasonics, circulation dynamics, bioenergetics, optics in medicine, applications of IR and UV radiation, medical transducers, particle radiation in medicine, models of the brain, molecular biophysics. Prerequisite: Phys 2 or equivalent.

151–52 **Intermediate Laboratory** (3–3) Taragin, Khatcheressian
Independent advanced work to introduce students to research techniques and use of specialized instruments. Laboratory fee, $15.
(Fall and spring)

161 **Mechanics I** (3) Pratt
Mechanics of mass points and rigid bodies. Newton's laws, conservation laws, Euler's equations, inertia tensor, small vibrations, and elements of Lagrange's and Hamilton's equations.

162 **Mechanics II** (3) Bergmann
Basic aspect of continua, including elasticity and fluid dynamics, strain tensor, stress tensor, equations of equilibrium, elastic waves, ideal and viscous fluids.

163 **Physical and Quantum Optics** (3) Eisenstein, Hobbs
Oscillations and waves, energy and momentum of the electromag-

netic field, interference, diffraction, geometrical optics, optics of crystals and other media, dispersion.

164 Thermodynamics (3) Taragin, Parke
Principles and applications of equilibrium thermodynamics, reversible processes, thermodynamic potentials, stability and phase changes.

165–66 Electromagnetic Theory (3–3) Zuchelli
Development of Maxwell's field equations using vector and tensor calculus, electrostatics, stationary and nonstationary phenomena, basic circuit theory, electromagnetic waves and radiation.

167 Principles of Quantum Physics (3) Harper
Development of logical structure and experimental bases for modern quantum mechanics. Simple examples worked out to clarify the structure; primary emphasis on conceptual framework and its mathematical realization; careful consideration of the laboratory results to which the theory is a response.

168 Applied Quantum Physics (3) Harper
Explicit applications of principles of quantum mechanics to a variety of problems in atomic, molecular and nuclear physics. Quantum statistical mechanics developed with applications in solid state. Emphasis on explicit evaluation of solutions and the techniques required. Prerequisite: Phys 167 or equivalent.

170 Elementary Solid State Physics (3) Khatcheressian, Eisenstein
Structure of solids, lattices and lattice defects, deformation, vibrational and electronic contribution to specific heats, binding energies, electronic states in metals and semiconductors, magnetic properties of solids. Elementary methods required such as quantum mechanics and normal mode expansions are developed as needed.

175 Nuclear Physics (3) Lehman, Prats
Introduction to application of quantum physics in the description of nuclei and their interactions. Properties of nuclei, nuclear models, nuclear forces, and nuclear reactions are considered. Specific topics include the deuteron, n-p scattering, the optical model, the shell model, the liquid-drop model, beta-decay, fission, and fusion. Prerequisite: Phys 167 or permission of instructor.

195–96 Undergraduate Research (3–3) Staff
Research on problems approved by the staff. For the B.A. option, emphasis will be placed on advanced laboratory experience. For the B.S. option, the two semesters will involve advanced laboratory experience and applications of computers in the solution of physics problems, respectively.

Third Group

Consent of a departmental graduate advisor is required for admission to all third-group courses in physics.

201–2 Interdisciplinary Science (4–4) Levy, Merchant, Parke
Joint offering of the Departments of Biological Sciences, Chemistry, and Physics. A treatment of scientific methodology and knowledge, both principles and facts. Designed to provide a basic understanding of the natural sciences and of the nature of science itself. Overview of the known fundamental principles developed in scientific observation of the physical universe. Fundamental principles are applied to systems of increasing complexity, with emphasis on physical, chemical, and biological systems. Students enrolled in natural science programs may not take this course for credit. Prerequisite: high school algebra or equivalent.

211 **Advanced Mechanics** (3) Bergmann
Analytic methods of mechanics as a basis for modern theory: variational principles, Lagrange's equations, Hamiltonian formulation, canonical transformations, classical perturbation theory.

212 **Special Relativity** (3) Zuchelli
Application of relativistic concepts to the basic fields of physics: space and time, tensors and covariant mechanics of point particles, covariant form of electromagnetism, relativistic variational principles, relativistic quantum equations.

213 **Electromagnetic Theory: Macroscopic Effects** (3) Eisenstein
Detailed consideration of classical electromagnetic field theory in vacuum and in electrically and magnetically active media. Boundary-value problems, multipole expansions, induced polarizations, time-dependent fields, frame dependence of the fields, gauge transformations, radiation fields.

214 **Electromagnetic Theory: Electrodynamics and Radiative Effects** (3) Bergmann, Eisenstein
Analysis of problems involved in obtaining the motion of charges in given electromagnetic fields and radiation from such charges. Covariant methods developed and used where suitable. Specific topics include radiation by moving charges, spectral decomposition and integrated flux, angular distribution of radiation, radiation reaction and anomalies.

221–22 **Quantum Mechanics** (3–3) Prats
General aspects of quantum mechanics with emphasis upon the developmental principles involved. Operators, representations and transformation theory. Schrödinger and Heisenberg pictures, angular momentum, perturbation theory, scattering theory. (Academic year)

224 **Statistical Mechanics** (3) Bergmann
Study of classical and quantum equilibrium statistical mechanics. Kinetic theory and transport phenomena reviewed prior to examining principles of statistical mechanics. Among topics considered: distribution functions, H-theorems, partition functions, Gibb's paradox, canonical ensemble, grand canonical ensemble, ideal gases, interacting gases, cluster expansion, virial expansion, and density matrices.

225–26 **Laboratory** (3–3) Hobbs
Individual work on special topics. Laboratory fee, $20 per semester. (Academic year)

231 **Quantum Electrodynamics: Theory and Applications** (3) Lehman
A presentation of the lower order effects depending upon the quantal nature of the electromagnetic field: Hamiltonian formulation and field quantization, perturbation calculations, Compton effect, photoelectric effect, electron-electron scattering, pair creation and annihilation, indices of refraction, divergence difficulties.

232 **Quantum Field Theory** (3) Bergmann
Covariant presentation of general theory of quantized fields, Bosan and Fermion fields, theory of S-matrix, dispersion relations, and renormalization program.

233 **Nuclear Theory** (3) Prats, Lehman, Harper
Nuclear interactions, nuclear models, theory of nuclear reactions, pion physics and weak interactions.

243 **Solid State Physics: Structure and Binding** (3) Khatcheressian, Hobbs, Taregin
Atomic structure of solids and analysis of the binding of crystals.

Crystalline forms and symmetries, atomic vibrations and specific heats, sound and optical propagation, crystalline defects.

244 **Solid State Physics: Electronic Processes in Metals** (3) Khatcheressian, Eisenstein
Phenomena in metals and semi-conductors determined by the electronic states allowed: binding, specific heats, magnetic properties, transport phenomena. Independent particle approximation and many-body aspects are discussed.

250 **Selected Topics in Modern Physics** (3) Staff
Possible topics include nuclear three-body problem; group theory and symmetry principles in physics; differential manifolds applied to physics; electric states and superconductivity; gauge field theories; dispersion relations and unitarity in scattering theory. May be repeated for credit with permission of graduate advisor. (Fall and spring)

291 **Seminar** (1) Staff
Lectures on special problems in physics. May be repeated once for credit. (Fall and spring)

299–300 **Thesis Research** (3–3) Staff
(Fall and spring)

Fourth Group

398 **Advanced Reading and Research** (arr.) Staff
Limited to students preparing for the Doctor of Philosophy general examination. May be repeated once for credit. (Fall and spring)

399 **Dissertation Research** (arr.) Staff
Limited to Doctor of Philosophy candidates. May be repeated for credit. (Fall and spring)

PHYSIOLOGY—GRADUATE PROGRAMS

Professors C.S. Tidball, R.A. Kenney *(Chairman)*, M.E. Tidball, M.M. Cassidy, M.J. Jackson
Associate Professors R.A. Lavine, D.W. Watkins
Assistant Professor J.K. Kelleher

Master of Science in the field of physiology—Prerequisite: a bachelor's degree. No major is specified, but the undergraduate program must have included the following courses or their equivalents: BiSc 11–12; Chem 11–12, 22, 151–52, 153–54; Math 31; Phys 1, 2.

Required: the general requirements, pages 89–96. In addition to the thesis, the 30 hours of required work includes Phyl 201, 205, 212, 221, 298.

Doctor of Philosophy in the field of physiology—Required: the general requirements, pages 89–91, 96–99. The program of study includes a major field in physiology, a subfield (see below) in physiology, and a minor field outside of physiology leading to the Cumulative Examination. The 48 semester hours of required course work leading to the Cumulative Examination includes Phyl 201, 205, 212, 221, 298, 396, 397.

Research fields and areas of study: applied physiology, cardiovascular physiology, cellular physiology, endocrine physiology, gastrointestinal physiology, neurophysiology, renal physiology, and respiratory physiology.

Departmental prerequisite: Phyl 201 or equivalent is prerequisite to all courses in physiology numbered above 201, except Phyl 205, 221, and 212.

Second Group

191 **Selected Topics in Human Structure and Function** (3) Kenney
Structural and functional basis of physiology. Required for graduate students who have not had Anat 201 or equivalent; students may receive graduate credit on completion of additional work as prescribed by the instructor. Prerequisite: BiSc 11–12 or equivalent and consent of instructor. Open to Columbian College students with the approval of the major advisor. (Fall)

Third Group

201 **Physiology** (8) Staff
Cellular, organ system, and applied mammalian physiology. Prerequisite for graduate students: Anat 201 or Phyl 191, or equivalent; Binc 221 or Phyl 205, or consent of chairman of department. Open to Consortium students only with permission of department chairman. (Spring)

205 **Cell Biophysics** (2) Jackson, Kelleher
Lecture (2 hours). An introductory survey of the mechanisms for interconversion and utilization of energy in animal cells. A required course for graduate students intending to take Phyl 201. Prerequisite: BiSc 11–12 or equivalent, and consent of instructor. Open to students in the Columbian College of Arts and Sciences with the approval of the student's major advisor. (Fall)

212 **Neurobiology** (3) Staff
Same as Anat 212. An integrated survey of the structure and function of the human nervous system; lecture, clinical demonstrations, and laboratory. Laboratory fee, $25. (Spring)

221 **Seminar** (1) Cassidy
Staff and student presentations from literature. Present work discussed, experimental design and scientific deduction evaluated. Topics to be announced. Content differs each time the course is offered; may be repeated for credit. (Fall and spring)

253 **Physiology of Fluid Balance and Hydrogen Ion Regulation** (2) Cassidy
Discussion on principles of fluid and acid-base balance and the application of these principles to scientific situations. (Fall)

260 **Membrane Physiology** (2) Jackson
Weekly lectures or seminar. Systematic review of the factors which determine the movements of water and solutes across simple cellular membranes and complex epithelial barriers in animal tissues. Prerequisite: Phyl 205 or permission of instructor. (Fall)

261 **Gastrointestinal Physiology** (1 or 2) Jackson
Weekly seminar; role of basic sciences in gastroenterology; intra- and extra-mural speakers. An approved paper required for two semester hours of credit. May be repeated for credit. (Fall and spring)

262 **Topics in Cardiovascular Physiology** (2) Kenney
Survey, at an advanced level, of aspects of cardiovascular physiology especially as interrelated with the respiratory and renal systems (Fall)

268 **Muscle Contraction: Physiological and Biochemical Aspects** (2) Walker, Frank
Joint offering of the Biochemistry and Physiology Departments. Anatomical, biochemical, pharmacological, and physiological aspects

of muscle contraction. Prerequisite: an introductory course in biochemistry and physiology, or permission of the department.

269 **Topics in Neurophysiology and Psychophysiology** (2) Lavine
Selected topics in contemporary neurophysiology, including methods of data collection and analysis, control mechanisms involved in movement and behavior and sensory processing. Open to students in the School of Engineering and Applied Science with permission of instructor. (Fall)

270 **Computer Utilization in Physiology and Medicine** (3) C. Tidball
Lecture one hour a week, practical experience at student's convenience. Orientation to processing analog and digital signals on mini-computers. Programming in assembly language as well as a high-level language of the student's choice. No previous computer experience necessary. (Fall)

271 **Computer Simulation of Physiological Processes** (3) C. Tidball
Lecture 1 hour a week; practical experience at student's convenience. Programming of physiological simulation will be learned by writing a series of simulations of increasing complexity. Prerequisite: Phyl 270 or equivalent or permission of instructor.

272 **Reading and Research in Simulation of Physiological Processes** (3) C. Tidball
Readings in physiological simulations and their evaluation. Informal discussions at regular intervals. Prerequisite: Phyl 271 or equivalent or permission of instructor. May be repeated once for credit.

295 **Research** (arr.) Staff
By special arrangement with individual staff members. Approximately four clock hours in the laboratory for each semester hour of credit. Content differs each time course is offered; may be repeated for credit. (Fall and spring)

298 **Comprehensive Physiology** (5) Staff
Guided review of selected areas of physiology appropriate to the student's graduate program. Prerequisite or concurrent registration: Phyl 221. (Fall)

299–300 **Thesis Research** (3–3) Staff
(Fall and spring)

Fourth Group

396 **Advanced Reading and Research** (2) Staff
Limited to students preparing for the Doctor of Philosophy general examination. Tutorial literature survey of a subfield of Physiology and of pertinent areas of the candidate's minor field. This course satisfies the requirement for Part II of the Cumulative General Examination in Physiology. (Fall and spring)

397 **Development of Dissertation Problem** (2) Staff
Limited to students preparing for the Doctor of Philosophy general examination. Preparation for written and oral presentation of dissertation problems. This course satisfies the requirement for Part III of the Cumulative General Examination in Physiology. (Fall and spring)

399 **Dissertation Research** (arr.) Staff
Limited to Doctor of Philosophy candidates. May be repeated for credit. (Fall and spring)

POLISH

See Slavic Languages and Literatures.

POLITICAL COMMUNICATIONS

Committee on Political Communications

P. Robbins *(Chairman)*, W.C. Adams, R.S. French, S.R. Lichter, J.S. Morgan, W.M. Reynolds, J.R. Thiel

Columbian College of Arts and Sciences offers an interdepartmental program in political communications leading to the degree of Bachelor of Arts. The following requirements must be fulfilled:

1. The general requirements on pages 71–72, 79–85. Majors in this field are advised that among the courses listed below, SpDr 49, 133, and 143 can be counted toward fulfillment of the meaningful initiation requirement in the humanities. The prerequisite courses in statistics can be counted toward the requirement in the natural and mathematical sciences.
2. Prerequisite courses:
   (a) Stat 51 or 53 and 97 or 105.
   (b) PSc 1 or 3 and 2; Econ 1–2.
   (c) SpDr 1, 49 or 143, 133 (SpDr 143 and 133 are recommended for the sophomore year).
   (d) Jour 71–72.
   (e) Psyc 1 or 5 or 6, and 151 (Psyc 151 is recommended for the sophomore year).
3. Required courses in the major (45 semester hours):
   (a) PSc 101, 120; three courses chosen from PSc 104, 111, 112, 114, 115, 116, 117, 118, 119, 122, 124, and Hist 134.
   (b) Jour 111; two courses chosen from Jour 137, 139, 145, 146, 150, 151.
   (c) SpDr 134; one course chosen from SpDr 112, 121, 126, 141; one course chosen from SpDr 145, 149, 175, 176.
   (d) PSc/Jour 128, PSc/Jour/SpDr 129, Jour 198, PCm 199.

191–92 **Field Experience** (3–3)
Open to juniors and seniors majoring in political communications. Students will spend at least 12 hours a week during the semester in an approved agency or office performing practical work in the subject under the general guidance of a faculty advisor.

199 **Senior Seminar in Political Communications** (3)
Limited to majors in political communications. Selected reading and discussion with possible field work in the professional subject.

POLITICAL SCIENCE

Professors R.E. Purcell, H.L. LeBlanc *(Chairman)*, B. Nimer, A. Gyorgy, H.C. Hinton, B.M. Sapin, J.A. Morgan, Jr., B. Reich, Y.C. Kim, S.J. Wayne, J.M. Logsdon

Professorial Lecturer R.G. Stevens

Associate Professors C.F. Elliott, C.A. Linden, H.R. Nau, D. Klingman, C. McClintock

Assistant Professors M.J. Sodaro, S.L. Wolchik, J.R. Henig, C.J. Deering, S.S. Smith, S.R. Lichter, H.B. Feigenbaum, C.C. Joyner, R.W. Rycroft, D.A. Bositis

Adjunct Assistant Professor G.R. Kieval

Bachelor of Arts with a major in political science (departmental)—The following requirements must be fulfilled:

1. The general requirements as stated on pages 71–72, 79–85.
2. Prerequisite: PSc 1 and 2. Six courses in the social sciences, other than

political science, to include six hours of history or six hours of economics. Twelve semester hours of introductory foreign language and statistics are strongly recommended.

3. Required courses in the major: 30 semester hours of second-group political science courses, including a distribution requirement which consists of six semester hours from each of the following groups: Group A (political theory and methodology)—PSc 101, 102, 104, 105, 106, 107, 108, 109, 110. Group B (American government and politics)—PSc 111, 112, 114, 115, 116, 117, 118, 119, 120, 122, 124, 129. Group C (comparative government and politics)—PSc 130, 131, 146, 165, 168, 170, 173, 177, 179, 180, 181, 183. Group D (international politics, law, and organizations)—PSc 140, 142, 144, 149, 161, 178, 182, 184.

Of the courses in Group A at least one must be PSc 101, 102, or 104, and it is recommended that this course be taken as early in the student's academic program as possible.

Every major must complete a proseminar or, if eligible, an Honors Seminar (PSc 196, 197, 198, or 199) in the junior or senior year. A maximum of two of these may be included in a student's program; such courses do not satisfy the department's group distribution requirements. A 200-level course may be substituted for the proseminar requirement with the permission of the instructor and the undergraduate coordinator.

The Department also offers a major with a public policy focus. Students who wish to concentrate in public policy must distribute their 30 hours in political science as follows: 3 semester hours from each of Groups A, B, C, D; PSc 104; 9 semester hours in policy-oriented courses to be selected from a group designated by the program advisor; and one policy-oriented proseminar.

Up to 12 hours of either service-learning or internship credit may be applied towards a degree. No more than six hours of such courses may be credited toward the major; these courses do not satisfy the distribution requirement.

Students in the 90-semester-hour degree program (see pages 80–81) must receive grades of *A* in at least 18 semester hours of second-group political science courses.

Students may apply for graduation with Special Honors. To qualify, the student must fulfill the general requirements (see page 50) and take at least one political science honors seminar in which an independent study project is completed with distinction. The project is reviewed by a Departmental Honors Committee. To be eligible for enrollment in an honors seminar, students must be political science majors, have successfully completed PSc 101, and have achieved a QPI in the major of at least 3.5 as juniors or at least 3.3 as seniors. PSc 101 may not be taken concurrently with the honors seminar.

Minor in political science—Required: 15 semester hours of second-group political science courses, including a distribution requirement of one course from each of the four groups listed in item 3 above. A minimum of 9 semester hours of other social science courses is also required.

Master of Arts in the field of political science—Prerequisite: a bachelor's degree with a major in political science from an accredited college or university, or an equivalent degree, and high undergraduate scholastic standing.

Required: The general requirements, pages 89–96, and either a reading knowledge of a modern foreign language or a specified level of knowledge in statistics, or two graduate-level courses in a cognate discipline. Students may elect one of the following programs: (1) 24 semester hours of graduate course work, plus a thesis (equivalent to six semester hours), and the satisfactory completion of a Master's Comprehensive Examination in three subfields selected from those listed under the Ph.D. program; or (2) 33 semester hours of graduate course work without a thesis and the satisfactory completion of a Master's Comprehensive Examination in four subfields selected from those listed under the Ph.D. program.

All students must take one course chosen from PSc 200, 230, or 240 during the first semester of graduate study. The course selected must have the approval of the coordinator of graduate studies.

Doctor of Philosophy in the field of political science—Students of outstanding ability are admitted to the doctoral program upon recommendation of a departmental graduate committee and the concurrence of the dean of the Graduate School of Arts and Sciences.

Required: The general requirements, pages 89–91, 96–99. Each student must complete a General Examination, which covers a major and minor field of study.

PSc 200 and 201 are required of all students unless they demonstrate knowledge of the courses' subject matter by passing a waiver examination.

Each student must choose a major and minor field of study from four principal subject-matter divisions. Each subject-matter division has several subfields of study from which the student, in consultation with an advisor, constructs a program. A major field of study consists of three subfields; a minor field of study consists of two subfields.

The subject-matter divisions and their subfields are (1) theory and methodology (analysis of Western political thought, analysis of Marxist and Marxist-Leninist thought, and scope and methods of political science); (2) comparative and foreign politics (comparative political analysis, regional comparative politics, and domestic politics of a specified major political system); (3) international relations (international politics, international law, international organization, regional international relations, and foreign relations of a specified major political system); and (4) American politics (American political process, national policy-making process, American constitutional law and judicial process, science policy, and state, local, and urban politics). Quantitative political analysis may be used as a subfield in any of the subject-matter divisions.

Departmental prerequisite: PSc 1 and 2 (or their equivalent) are prerequisite to all second-group courses in political science.

First Group

1 **Introduction to Comparative and International Politics** (3) Gyorgy, Sodaro
Comparative and international political systems; emphasis on structures and processes of major foreign governments and the force of basic ideologies. (Fall and spring)

2 **Introduction to American Politics and Government** (3) Purcell, LeBlanc, Wayne, Morgan, Smith
Structure, powers, and processes of the American political system. (Fall and spring)

3 **Introduction to Political Behavior** (3) Lichter
Study of political behavior, including the role of politics in today's world, the sources of elite and mass political behavior, and the influence and nature of political institutions. May be taken only with joint registration in Hum 3. (Fall)

91 **East Asia—Past and Present** (3) Johnson and Associated Faculty
An interdisciplinary course, introducing the student to a comprehensive and integrated understanding of the civilization and present problems of East Asia.

Second Group

101 **Scope and Methods of Political Science** (3) Kim, Smith, Bositis
Nature of political inquiry, approaches to the study of politics and government, empirical methods of research. (Fall and spring)

102 Empirical Political Analysis (3) Smith, Bositis
Extensive examination of empirical research methods in the analysis of political behavior. Research design, data collection (survey and aggregate), and data analysis. Prerequisite: PSc 101 or permission of instructor. (Spring)

104 Methods of Public Policy Analysis (3) Henig, Klingman
Models and case studies of public policy formation and changes, techniques of policy analysis and evaluation, normative implications of alternative policy-making frameworks. (Spring)

105 Political Theory: Major Issues of Western Political Thought I (3) Linden
Foundations of Western political thought—Plato to Aquinas. (Fall and spring)

106 Political Theory: Major Issues of Western Political Thought II (3) Linden
Theoretical roots of modern political order and disorder—Machiavelli to Rousseau. (Fall and spring)

107 Issues in Modern Political Thought (3) Linden, Wolchik
Issues of modern political thought as seen through major representative thinkers. Emphasis on conservative, liberal, and radical thought. (Fall)

108 Modern Communist Ideologies (3) Elliott
Intensive study of theories and philosophical assumptions of modern communism. Emphasis on the careers and ideas of leading figures: Marx, Engels, Lenin, Stalin, Khrushchev, and Mao. (Spring)

109 Democratic Theory (3) Staff
Issues of recent democratic thought and theory, particularly in relation to the contemporary American political process. (Fall)

110 American Political Thought (3) Morgan
Political thought in the U. S. from colonial times to the present as seen through major representative writings. (Spring)

111 State and Urban Politics (3) Henig
Comparative analysis of context, institutions, processes, and policies of state and urban political systems. (Fall)

112 State and Urban Policy Problems (3) Henig
Selected issues in state and urban policy-making, with emphasis on urban and metropolitan settings. (Spring)

114 U.S. Constitutional Law and Politics I (3) Morgan
Separation of powers, federal-state relationships, economic regulation. (Fall)

115 U.S. Constitutional Law and Politics II (3) Morgan
Political and civil rights. (Spring)

116 The American Presidency (3) Wayne
Examination of the politics of presidential selection, the authority of the contemporary institution, the mechanisms and processes for formulating public policy, and the influences of personality on performance. (Fall and spring)

117 Public Administration and Bureaucratic Politics (3) Rycroft
Basic concepts in public administration; influence of bureaucratic politics on policy formulation and implementation. (Spring)

118 Legislative Process (3) Deering, Smith
Theory, structure, and process of the U.S. Congress, with emphasis on elections, party organization, committees, and floor procedure, in the context of executive-legislative relations and interest-group activities. (Fall and spring)

119 U. S. Political Parties and Politics (3) LeBlanc
Role of parties as a linkage between mass preferences and government policies. Organization, nominations, voting, and activities in legislative and executive branches. (Fall and spring)

120 Public Opinion and Political Socialization (3) Staff
Sources of mass political attitudes and behavior; voting and political campaigning. (Fall)

122 Science, Technology, and Politics (3) Logsdon
Multiple impacts of scientific and technological developments on the political systems. Discussion of public policies for support, use, and control of science and technology. (Fall and spring)

124 Issues in Domestic Public Policy (3) Henig, Deering
Examination of the decision-making process and the substance of various issues in domestic public policy in such areas as crime, economics, education, energy, the environment, poverty, and health. (Fall and spring)

129 TV News: The Politics of Visibility (3) Lichter
Examination of the impact of television on American politics and society, the nature of coverage of political issues and campaigns, the dynamics of selecting and presenting news stories. Same as Jour SpDr 129. (Fall and spring)

130 Comparative Government and Politics I (3) Feigenbaum, McClintock
Comparative political analysis with primary focus on the principal states of Western Europe. (Fall and spring)

131 Comparative Government and Politics II (3) Gyorgy, Sodaro, Wolchik
Government and politics of the communist nations; emphasis on the Soviet Union and countries of Eastern Europe. (Fall and spring)

140 International Politics (3) Nau, Joyner
International actors, international and domestic environments of foreign policy, global and regional patterns, general characteristics of foreign policy. (Fall and spring)

142 International Organizations (3) Nau, Stambuk
Development and operations of the United Nations, regional organizations, and functional international organizations. (Fall and spring)

144 Public International Law (3) Joyner
Survey of international law; emphasis on development and trends. (Fall and spring)

146 U. S. Foreign Policy (3) Purcell
Constitutional, political, and international factors that determine the formulation, execution, and substance of U.S. foreign policy. (Fall and spring)

149 Military Force and Foreign Policy (3) Sapin, Lewis
Impact of military considerations on U.S. foreign policy; major problems in national security, e.g., strategic weaponry, military assistance, regional security problems. (Fall)

161 European-Atlantic Relations (3) Stambuk
International politics of the North Atlantic area, the European Common Market, and U.S.-European relations. (Fall)

165 Government and Politics in Eastern Europe (3) Gyorgy
Study of the contemporary social and ethnic structures, govern-

mental systems, and international position of the Eastern European states within the Soviet system. (Summer)

168 **Soviet Foreign Policy** (3) Elliott
Relations with U. S., Europe, Third World, China; international communism; instruments of foreign policy; interrelationships between domestic and foreign policies; ideology and foreign policy. (Fall)

170 **Governments and Politics of China and Japan** (3) Hinton
Political institutions and processes of China since 1949 and of Japan since 1945. Influence of indigenous traditions and foreign contacts. (Fall, odd years)

173 **Governments and Politics of South and Southeast Asia** (3) Hinton
Interaction of traditional, colonial, and contemporary influences in the domestic and international politics of the Indian subcontinent and of mainland and insular southeast Asia. (Fall, even years)

177 **Governments and Politics of the Middle East** (3) Reich
Politics of the eastern Arab states, Turkey, Iran, Israel. (Fall)

178 **International Relations of the Middle East** (3) Reich
Analysis of the regional and international relations of the Middle East. (Spring)

179 **Israeli Foreign Policy** (3) Reich
Examination of the institutions, processes, and issues of Israeli foreign policy. (Fall)

180 **Governments and Politics of North Africa** (3) Reich, Lewis
Domestic and international politics of Algeria, Tunisia, Morocco, Libya, Egypt, Sudan; their relations with states of the Middle East. (Spring)

181 **Politics of Middle and Southern Africa** (3) Nimer
Comparative analysis of political systems in selected countries of non-Mediterranean Africa. (Fall)

182 **African International Politics** (3) Nimer
Analysis of interstate relations in Africa and of selected aspects of African relations with the outside world. Recommended prerequisite: PSc 181 or equivalent. (Spring)

183 **Governments and Politics of Latin America** (3) McClintock
Political processes and institutions in Latin America, particularly Mexico, Chile, Peru, Brazil, and Cuba. Emphasis on issues of reform and revolution. (Fall)

184 **International Relations of Latin America** (3) McClintock
U. S.-Latin American relations, inter-American diplomacy and organization, foreign policies of selected states. (Spring)

*187 **Internship: Political Behavior** (3) Deering
Study of political behavior through internship experience with Congress, executive departments or agencies, politically active private-sector groups, political parties, or electoral campaigns. May be repeated for credit with approval. (Fall and spring)

*188 **Internship: Urban Affairs** (3 or 6) Henig
Study of urban political and policy-making processes through assignment to an urban-related political or governmental office. Primarily for senior urban affairs majors. (Fall and spring)

*189 **Internship: Legal Process** (6) Love
The legal system and its role in promoting social change. Readings, group discussions, and work with lawyers and third-year law students. (Fall and spring)

* Admission requires departmental approval.

190 **Selected Topics in Political Science** (3) Staff
(Fall and spring)

*191 **Selected Topics: International Affairs** (3 or 6) Staff
Examination of selected problems in international relations. (Fall and spring)

*192 **Proseminar: Political Science** (3) Staff
Examination of selected problems in political science. (Fall and spring)

*193 **Proseminar: Urban Affairs** (3 or 6) Henig
Readings, research, and class discussion on selected topics in urban politics and policy-making. Primarily for senior urban affairs majors. (Fall and spring)

*196 **Honors Seminar: Political Theory** (3) Staff
Research on selected topics. Prerequisite: PSc 101.

*197 **Honors Seminar: American Government and Politics** (3) Staff
Research on selected topics. Prerequisite: PSc 101.

*198 **Honors Seminar: Comparative Government and Politics** (3) Staff
Research on selected topics. Prerequisite: PSc 101.

*199 **Honors Seminar: International Politics** (3) Staff
Research on selected topics. Prerequisite: PSc 101.

Third Group

200 **Scope and Methods of Political Science** (3) Linden, Smith, Bositis
Introduction to the discipline and profession, analysis and comparison of some approaches to political inquiry, and empirical research design. (Fall and spring)

201 **Empirical Political Analysis** (3) Smith, Bositis
Techniques of social science data analysis. Emphasis on using computers for statistical analysis in political research. No previous experience with statistics or computers required. (Fall)

202 **Advanced Topics in Empirical Political Analysis** (3) Smith, Bositis
Advanced techniques of data collection and analysis; varying emphasis on such methods as causal modeling, analysis of variance, regression analysis, and simulation. (Spring)

203 **Public Policy Analysis** (3) Henig, Klingman
Reading and research on systematic methods of public policy analysis. (Spring)

204 **Methods of Legislative Research** (3)
The process of empirical research: construction of research design, data collection, and analysis. Techniques discussed will include content analysis, survey research, and analysis of institutional voting.

205 **Readings in Political Theory** (3) Linden
Selected major works, both ancient and modern, which illuminate basic problems and questions of political theory. (Fall)

206 **Topics in Political Theory** (3) Linden
Advanced readings and group discussions. Analysis and interpretation of selected concepts and schools of thought. (Spring)

207 **Readings in Socialism and Communism** (3) Elliott, Linden, Wolchik
Readings and discussions of works illuminating the development of pre- and post-Marxian socialist thought. (Fall)

208 **Readings in Marxism-Leninism** (3) Elliott, Linden
Readings and discussions in Marxism-Leninism and its controversies from Lenin to the present. (Spring)

* Admission requires departmental approval.

211 **State and Urban Politics** (3) Henig
Comparative analysis of the context, institutions, processes, and policies of state and urban political systems.

212 **State and Urban Policy Problems** (3) Henig
Analysis of public policy issues confronting state and urban governments; emphasis on the theoretical roots and empirical impact of past and present programs in such areas as housing, education, poverty, and crime.

214 **Topics in Constitutional Law** (3) Morgan
Lectures and group discussions on constitutional law and politics. (Fall, even years)

215 **Judicial Policy-making** (3) Morgan
Role of the judiciary in policy formulation; emphasis on the U.S. Supreme Court and civil liberties issues. (Fall, odd years)

216 **American Presidency** (3) Wayne
Personalized and institutionalized aspects of the presidency with particular emphasis on the politics of legislative policy-making. (Fall)

217 **Bureaucratic Politics** (3) Rycroft
Structure and operation of governmental bureaucracy with particular emphasis on the politics of formulating and implementing public policy. (Spring)

218 **Legislative Theory and Behavior** (3) Deering, Smith
Theory, structure, and process of the U.S. Congress, with emphasis on member-constituency relations, individual and collective decision-making, party and committee activities, executive-legislative relations, and interest-group activities. (Spring)

219 **American Political Parties and Electoral Behavior** (3) LeBlanc
Nature and functions of political parties, with special emphasis on party influences on electoral behavior and congressional decision-making. (Fall)

220 **Public Opinion and Political Socialization** (3) Staff
Sources and dynamics of public opinion and political socialization. (Spring)

222 **Government, Science, and Technology** (3) Logsdon, Rycroft
National and international policy issues which arise from the interaction between scientific and technological development and governmental activity. (Fall)

223 **Science, Technology, and Public Affairs** (3) Logsdon, Rycroft
Intensive examination of selected public policy issues with significant scientific or technological aspects. Prerequisite: PSc 222 or permission of instructor. (Spring)

224 **Domestic Policy Analysis—Selected Topics** (3)
Analysis of U.S. policy toward selected domestic problems.

225 **Issues in Political Economy: Economic Policy Analysis** (3)
Analysis of selected topics in U.S. monetary and fiscal policy. Offered off campus only.

226 **Issues in Political Economy: The Economic Policy Process** (3)
Economic analysis of selected legislative issues and the effect of various economic pressures on policy outcomes. Offered off campus only.

230 **Comparative Government and Politics I** (3) Kim, McClintock, Feigenbaum
Examination of basic approaches to comparative politics. (Fall)

231 **Comparative Government and Politics II** (3) Kim, McClintock, Feigenbaum
Comprehensive examination of specific issue areas in comparative political analysis. (Spring)

232 **Comparative Communist Systems I** (3) Wolchik
Comparative analysis of the political history and contemporary political processes of communist states, with emphasis on the Soviet Union and Eastern Europe. Same as Hist 232. (Fall)

233 **Comparative Communist Systems II** (3) Wolchik
Comparative analysis of the political history and contemporary political processes of communist states, with emphasis on China and Cuba, and non-ruling communist parties. Same as Hist 233. (Spring)

234 **Comparative Legislative Systems** (3)
Selected problems of legislative theory and behavior from a comparative perspective with particular reference to the parliamentary systems of West Germany, France, and Britain.

240 **Theories of International Politics I** (3) Nimetz
Critical examination of contemporary theories, both empirical and normative, with emphasis on actor theory. (Fall)

241 **Theories of International Politics II** (3) Nimetz
Critical examination of contemporary theories, both empirical and normative, with emphasis on interaction theory. (Spring)

242 **Problems in International Organizations I** (3) Nau, Stambuk
Collective security, law, and the politics of international organizations. (Fall)

243 **Problems in International Organizations II** (3) Nau, Stambuk
Social and economic interdependence and the politics of international organizations. (Spring)

244 **International Law I** (3) Joyner
Readings in selected areas. (Fall)

245 **International Law II** (3) Joyner
Research in selected areas. (Spring)

246 **U. S. Foreign Policy** (3) Purcell
Research and selected reading as the basis for analysis of U.S. foreign policy. Particular reference to the decision-making process and policy execution. (Fall)

247 **Public Opinion and Foreign Policy** (3) Purcell
Research and readings on U.S. public opinion interest groups that influence foreign policy. (Spring)

248 **U. S. National Security Policy-making** (3) Sapin
Executive organization and processes for national security policy-making. Attention to relevant theoretical approaches. (Fall)

249 **U. S. National Security Policy** (3) Sapin, Lewis
Fundamental considerations; selected issues, e.g., arms control and disarmament, regional security problems, military assistance. (Spring)

250 **Foreign Policy Analysis—Selected Topics** (3) Nau
Analysis of U.S. foreign policy toward selected world regions.

252 **Science, Technology, and World Order** (3)
Intensive reading, discussion, and research on the impact of science and technology on world order, in particular on the claim that a new global politics is replacing traditional or nation-state politics. (Spring)

258 **Communist Party of the Soviet Union** (3) Sodaro
Analysis of the internal evolution of the Community Party and its role in the Soviet system from its origins to the present day. Same as Hist 258. (Spring)

260 **Western European Politics** (3) Feigenbaum
Examination of the principal characteristics of the British, French, West German, and Italian political systems, comparing their institutional and behavioral adaptations to the problems of advanced industrial democracies. (Fall)

261 **Politics of the European Community** (3) Stambuk
Problems in Western European politics, with emphasis on supranational political processes and selected policy outcomes in the context of the European Common Market. (Spring)

263 **Communism in Non-Communist Europe** (3) Sodaro
Examination of non-ruling European communist parties; relations between these parties and other ruling and non-ruling communist parties.

264 **The International Politics of Eastern Europe** (3) Gyorgy and Staff
Major historical, political, social, and regional factors which have shaped the inter-war, World War II, and post-war evolution of Eastern Europe; emphasis on foreign relations with outside powers and on regional East-West contacts. (Spring)

265 **Governments and Politics of Eastern Europe** (3) Gyorgy and Staff
A comparative study of Eastern European states: political, social, economic institutions; emphasis on domestic conditions and problems of individual Eastern European countries. (Fall)

266 **Readings in Soviet Government and Politics** (3) Elliott, Linden
Readings in contemporary Soviet domestic government and politics. (Fall)

267 **Soviet Government and Politics** (3) Elliott, Linden, Wolchik
Research seminar in selected problems of Soviet domestic government and politics. Emphasis: since Stalin. Prerequisite: PSc 266 or permission of instructor. (Spring)

268 **Soviet Foreign Policy** (3) Elliott
External problems and policies of the USSR, with emphasis on the period since Khrushchev. Relations with other communist states, Western powers, other countries, and non-ruling communist parties. (Spring)

269 **Soviet Military Policy and Strategy** (3) Wolfe, Elliott
Soviet developments in military policy and strategy with attention to intra-bloc military cooperation, political context of Soviet military policy, significant changes in recent Soviet military thought. (Fall or spring)

270 **Politics of the People's Republic of China I** (3) Hinton
Introduction to the substance of and literature on contemporary Chinese politics. Discussion and reading. (Fall)

271 **Politics of the People's Republic of China II** (3) Hinton
Research seminar. Introduction to the analysis of official Chinese documents; presentation of student papers. (Spring)

272 **Foreign Policy of the People's Republic of China** (3) Hinton
Objectives; formulation and implementation; the People's Republic of China as Asian state, revolutionary influence, would-be great power. (Spring, even years)

273 **Governments and Politics of South and Southeast Asia** (3) Purcell
Research and selected readings as basis for analysis of structure,

problems, and policies of the governments of selected countries particular reference to India. (Spring)

275 **International Politics of the Far East** (3) Hinton
Foreign policies and international behavior of the regional states (especially China, Japan, and Vietnam) and the extraregional powers [especially the U.S. and the U.S.S.R.]. (Spring, odd years)

276 **Governments and Politics of Japan and Korea** (3) Kim
Readings and research on the domestic and foreign policies of Japan, North and South Korea. (Fall or spring)

277 **Governments and Politics of the Middle East** (3) Reich
Readings and research on selected problems of the governments and politics of the Middle East. (Fall)

278 **International Relations of the Middle East** (3) Reich
Readings and research on the regional and international relations of the Middle East. (Spring)

280 **Governments and Politics of North Africa** (3) Reich, Lewis
Readings and research on selected problems in the governments politics, and international relations of North Africa. (Spring)

281 **Topics in African Politics** (3) Nimer
Readings, research, and discussion of selected aspects of African domestic and international politics. (Spring)

283 **Governments and Politics of Latin America** (3) McClintock
Readings and discussion on politics in Latin America, particularly Mexico, Chile, Peru, Brazil, and Cuba. Emphasis on issues of reform and revolution. (Fall)

284 **International Relations of Latin America** (3) McClintock
Readings and discussion on U.S.-Latin American relations and the foreign policies of selected states. (Spring)

285 **Problems in Latin American Civilization** (3) Staff
Same as Anth/Econ/Geog/Hist/Rom 287. Interdisciplinary seminar each student writes a report on some aspect of a selected key theme May be repeated for credit. Admission by permission of instructor (Fall and spring)

286 **Selected Topics in American Politics** (3) Staff
Readings and discussion. (Fall or spring)

287 **Selected Topics in Political Theory** (3) Staff
Readings and discussion. (Fall or spring)

288 **Selected Topics in Comparative Politics** (3) Staff
Readings and discussion. (Fall or spring)

289 **Selected Topics in International Politics** (3) Staff
Readings and discussion. (Fall or spring)

290 **Colloquium: Middle East** (3) Reich
Interuniversity colloquium for advanced students of Middle East affairs. Admission by permission of the instructor. (Fall and spring)

291 **Colloquium: East Asia** (3) Hinton
Interuniversity colloquium for advanced students of Far Eastern affairs. Admission by permission of the Instructor. (Fall and spring)

292 **Colloquium: Russia and Eastern Europe** (3) Gyorgy
Interuniversity colloquium for advanced students of Russian and Eastern European affairs. Admission by permission of the instructor (Fall and spring)

297 **Reading** (3) Staff
Limited to master's degree candidates. Written permission of instructor required. (Fall and spring)

298 Research (3) **Staff**
Limited to master's degree candidates. Written permission of instructor required. (Fall and spring)

299–300 Thesis Research (3–3) **Staff**

Fourth Group

301 Advanced Reading and Research in Political Theory (3) **Staff**

310 Advanced Reading and Research in American Politics (3) **Staff**

340 Advanced Reading and Research in Comparative Politics (3) **Staff**

350 Advanced Reading and Research in International Politics (3) **Staff**

397 Advanced Reading (3) **Staff**
Limited to students preparing for the Doctor of Philosophy general examination. May be repeated for credit. (Fall and spring)

398 Advanced Research (arr.) **Staff**
Limited to students preparing for the Doctor of Philosophy general examination. May be repeated for credit. (Fall and spring)

399 Dissertation Research (arr.) **Staff**
Limited to Doctor of Philosophy candidates. May be repeated for credit. (Fall and spring)

PORTUGUESE

See **Romance Languages and Literatures.**

PSYCHOLOGY

Professors T. Hunt *(Emeritus)*, E.L. Phillips, J.N. Mosél, B.I. Levy, W.E. Caldwell, R.D. Walk *(Chairman)*, R.K. White *(Emeritus)*, A.D. Kirsch, E. Johnson *(Emeritus)*, V. Kirkbride *(Emeritus)*, C.E. Rice, E. Abravanel, D.E. Silber, J. Miller, C.J. Lange, A.J. Caron *(Research)*, F.L. Schmidt *(Research)*, L.A. Rothblat, M.L. Meltzer
Adjunct Professor R.F. Caron
Professorial Lecturers R.K. Kahn, S.L. Cohen
Associate Professors C.E. Tuthill, R.H. Tanck *(Research)*, S.A. Karp, R.W. Holmstrom, P.J. Poppen, L. Brandt, S.K. Green
Adjunct Associate Professor D.G. Kleiman
Associate Professorial Lecturer J.K. Harper
Assistant Professors S. Hashtroudi, L.R. Offermann

Clinical Training Staff

Clinical Professor J. Borriello
Associate Clinical Professors I.M. Zimmerman, J.W. Cummings, M.E. Zedek, E. Blum, P.D. Daen, D.A. Evans

Bachelor of Arts with a major in psychology (departmental)—The following requirements must be fulfilled:
1. The general requirements as stated on pages 71–72, 79–85.
2. Prerequisite courses—seven or eight semester hours selected from Psyc 1, 5 and 6.
3. Required courses in related areas:
(a) three semester hours selected from Stat 51, 53, or any first-group course in mathematics except Math 6. (Students expecting to do graduate study in psychology should elect Stat 53.)
(b) 9 semester hours selected from American civilization, anthropology,

economics, geography and regional science, history, philosophy (Phil 71, 11
151 recommended), political science or sociology, of which six hours must b
from one of the following: anthropology, economics, history, political scienc
or sociology. If a student takes more than six hours in any one departmen
the excess will be credited to electives.

4. Required courses in the major—27 semester hours in second-group psy
chology courses, including Psyc 196 and one course from each of the following
groups—*Group A*: Psyc 118, 121, 161; *Group B*: Psyc 115, 144, 151, 156; *Group C*
Psyc 101, 129, 131; *Group D*: Psyc 110, 112, 132.

It is recommended that students contact their academic advisors as soon as
possible for assistance in planning their programs of study.

Although there is no foreign language requirement, students contemplating
graduate study are reminded that most graduate schools require knowledge
of one and sometimes two foreign languages.

To qualify for graduation with Special Honors the student must fulfill the
general requirements (see page 50), take an honors seminar (Psyc 197), and
complete an independent study project (Psyc 191) with distinction. The grade
point average in psychology required for graduation with Special Honors is 3.5

Minor in psychology—18 semester hours are required, including Psyc 1 and
at least 9 semester hours of second-group psychology courses. Students con
sidering graduate study in psychology are advised to take Psyc 5 or 6, a distri
bution of courses from categories A, B, C, D above, Psyc 196, and an elementary
course in statistics.

Master of Arts in the field of psychology—Prerequisite: the degree of Bache
lor of Arts with a major in psychology at this University, or an equivalent
degree. Admission to the program is limited; preference will be given those
who plan to continue toward a Doctor of Philosophy degree.

Required: the general requirements, pages 89–96. Of the 24 required se
mester hours (exclusive of the thesis), a minimum of 18 must be in third-group
psychology courses including Psyc 202 and either 203 or 204; six may be in
related fields approved by the department. For detailed requirements consult
the chairman of the department.

Doctor of Philosophy in the field of psychology—Prerequisite: the degree of
Bachelor of Arts with a major in psychology. Students admitted from other
disciplines will be expected to complete prerequisite undergraduate courses
to prepare for graduate study in psychology. Qualifying scores on the Miller
Analogies Test and the Aptitude Test of the Graduate Record Examination are
required for admission.

Required: the general requirements, pages 89–91, 96–99, including (1) the
satisfactory completion of the tool requirement; (2) Psyc 202, 203–4, Stat 106
and (3) the satisfactory completion of a Preliminary Examination and a major
Field Examination.

Areas of study: clinical, developmental, experimental, industrial and organi-
zational, and social psychology.

Departmental prerequisite: Psyc 1 or 5 or 6 is prerequisite to all other
courses in psychology. The departmental prerequisite may be waived with the
permission of the instructor.

Students electing psychology courses in the freshman year should begin
with Psyc 1; with permission of instructor students may elect Psyc 5–6 in the
freshman year.

First Group Staff

1 General Psychology (3) (Fall and
Fundamental principles underlying human behavior. spring)

5–6 **Principles and Methods of Psychology** (4–4) Walk, Hashtroudi
Lecture (3 hours), laboratory (3 hours). An experimental approach to understanding behavior; individual and class experiments performed. Psyc 5: sensation, perception, and emotions and their relation to adaptive behavior. Psyc 6: memory, human information processing, learning, and motivation. Laboratory fee, $10 per semester. (Academic year)

8 **Psychology of Motivation and Personality** (3) Tuthill, Tanck
Introduction to the psychology of personality. Principles of motivation, personality development, social and cultural factors, and assessment and description of personality emphasized. (Fall and spring)

22 **Introduction to Educational Psychology** (3) Kirkbride, Tanck
The contributions of psychology to education; emphasis on learning.

29 **Psychology of Childhood** (3) Brandt
Developmental approach to study of the child. Emphasis on the socialization process, learning, and the child's view of the world.

Second Group

101 **Abnormal Psychology** (3) Silber, Holmstrom
Causes, diagnosis, treatment, and theories of various types of maladjustments and mental disorders. (Fall and spring)

104 **Ecology and Mental Health** (3) Karp
Examination by field research of the linkages between aspects of the physical environment and mental health. Lectures and student field research projects. (Fall)

105 **The Psychology of Consumer Behavior and Attitudes** (3) Phillips
Consumer behavior and attitudes in regard to advertising, buying habits, consumer action groups and social pressures, and mass persuasion. Lectures and field work. (Spring)

108 **Humanistic Psychology** (3) Mosél
Critical examination of humanistic psychology. Emphasis on role of consciousness in human behavior. Philosophic foundations, existential and phenomenological psychology, the new mentalism. (Spring)

110 **Perception and Understanding in Children** (3) Abravanel
Concepts and research in the area of developmental psychology; emphasis on the growth and development of perception, cognition, and language. (Spring)

112 **Psychology of Adolescence** (3) Staff
Psychological characteristics and problems peculiar to adolescence, with emphasis on application of psychology to solution of such problems. (Fall and spring)

115 **Psychology of Language and Communication** (3) Mosél
Introduction to psycholinguistics and verbal behavior. Information theory, generative grammar theory, cultural and linguistic structures in the perception and learning of language. (Fall and spring)

117 **Psychology of Art and Picture Perception** (3) Walk
Principles of perception as applied to art. Theories of Arnheim, Gibson, Gombrich, and Goodman as related to art and picture perception; study of cross-cultural research and research with children.

118 **Neuropsychology** (3) Rothblat
Analysis of neural processes underlying behavior. Basic structure and functions of the nervous system, with emphasis on sensory processes, learning and memory, motivation, and emotion. (Fall and spring)

119 Group Dynamics (3) Miller
Relationship of the individual to groups, collectivities, and larger social systems. Theory, research, and applications of group and organizational processes, emphasizing contributions of Freud, Bion, Slater, Miller and Rice. Opportunity is provided to attend a group dynamics workshop, which is recommended but not required. Enrollment limited. (Spring)

121 Psychology of Learning (3) Hashtroudi
Theories and issues related to basic learning processes as determinants of behavior. Emphasis on current research using both human and animal subjects. (Fall)

122 Psychology and Human Relations (3) Silber
Understanding human relations and T-group techniques by evolving an on-going T-group within the course itself. For junior and senior undergraduate social science majors; open to others with permission of instructor. (Summer)

129 Theories of Personality (3) Karp, Poppen
Survey of personality theories; emphasis on their application to problems of individuals. (Fall and spring)

130 Seminar: Political and Social Implications of Current Approaches to Psychological Treatment (3) Karp
Discussion and presentation of recent works, such as those of Szasz, Goffman and various writers on minority liberation, bearing upon the implications for individuals and society of various approaches to psychological treatment, including psychotherapy and behavior modification.

131 Psychological Tests (3) Hunt, Karp, Holmstrom
Survey of psychological tests and their more common uses in business, industry, government, law, medicine, and education. Material fee, $10. (Fall and spring)

132 Socialization in Childhood (3) Brandt
Examination of primary methods by which the child is shaped in terms of social judgment and self control; internalization of controls, assimilation of societal values and parenting procedures. Organized by focus on issues according to developmental level.

135 Freud and Modern Psychoanalysis (3) Miller
Introduction to the work of Freud and his impact on modern psychoanalysis, focusing on the meaning of dreams and the unconscious function of conflict and defense, infantile sexuality and the Oedipus conflict, development of the ego, theory of anxiety and neurosis, and the death instinct. (Spring)

144 Personnel and Industrial Psychology (3) Offermann
Psychological concepts and methods applied to problems of personnel management, supervisory leadership, employee motivation and productivity. (Fall and spring)

150 Psychology of Sex Differences (3) Poppen
Relevant biological, psychological, and sociological influences on males and females in the development of sex differences; hormonal differences, gender identity, differential socialization of sons and daughters, masculinity/femininity, cultural evaluation of male and female roles. Survey of relevant psychological theory. Emphasis on empirical research and hypothesis testing.

151 Social Psychology (3) Tuthill, Poppen, Green
Social foundations of attitudes and behavior: cognition, motivation, role-behavior, communication, small-group processes, and racial attitudes. (Fall and spring)

154 **Psychology of Criminology** (3) **Silber**
Examination of many psychological aspects of criminal behavior; personality of criminals and of psychological processes affecting behavior. (Fall)

156 **Psychology of Attitudes and Public Opinion** (3) **Tuthill**
Psychology of opinion formation, measurement of opinion, social determinants of attitudes, psychological processes in propaganda, bases of receptivity to propaganda, psychological warfare.

158 **Psychology of Interpersonal Attraction** (3) **Green**
Psychological bases for interpersonal attraction; emphasis on personal variables, relevant theoretical approaches and effects of attraction on other behavior.

161 **Comparative Psychology** (3) **Caldwell**
Lectures and demonstrations on animal psychology. Psychological processes in infrahuman organisms, evolution of behavior, the place of animal experimentation and research in psychology. (Spring)

168 **Principles and Techniques in Neuropsychological Research** (3) **Rothblat**
Introduction to basic anatomical, physiological and behavioral techniques used in neuropsychological research to explore relationships between the brain and behavior. Admission by permission of instructor. Laboratory fee, $20. (Spring)

170 **Clinical Psychology** (3) **Levy**
An exploration of the history, functions, and problems of the clinical psychologist. Assessment, treatment, community approaches, ethics Prerequisite: Psyc 101, 131. (Spring)

188 **Attitudes toward Death and Dying** (3) **Staff**
Exploration of the many different aspects, attitudes, and experiences associated with the process of death and dying. Limited to juniors and seniors.

191 **Independent Research in Psychology** (3) **Staff**
Opportunity for work on individual library or experimental projects. Open to qualified students by permission; arrangements must be made with the sponsoring faculty member prior to registration. May be repeated once for credit. (Fall and spring)

192 **Field Experience in Psychology** (3) **Abravanel**
Senior psychology majors will spend a minimum of six hours a week in a local mental health, rehabilitation, school, or community setting. Students registering for this course must have prior approval of the instructor. (Fall and spring)

196 **History and Systems of Psychology** (3) **Caldwell, Rice**
Senior capstone course which includes a survey and integration of the major viewpoints and concepts of psychology. Required of psychology majors. (Fall and spring)

197 **Honors Seminar in Psychology** (3) **Staff**
Selected topics in psychology which change from semester to semester. Intended primarily for juniors who plan to enroll in Psyc 191 (independent research) in the senior year. May be repeated for credit.

198 **Current Research Issues in Psychology** (3) **Staff**
Conducted as a seminar. Recent experiments in psychology, including those performed by members of the class; emphasis on student participation. May be repeated for credit.

Third Group

Third-group courses are limited to graduate students in psychology, except by special permission of instructor.

202 **Psychological Research Methods and Procedures** (3) Abravanel, Holmstrom
Required in all graduate psychology programs. Prerequisite: graduate standing, a laboratory course in psychology, and an elementary course in statistics. (Spring)

203–4 **Experimental Foundations of Psychology** (3–3) Hashtroudi, Rothblat and Staff
Required of doctoral students in psychology during first year of study. Psyc 203: basic issues in learning and motivation. Psyc 204: physiological processes; sensation and perception. (Academic year)

206 **Methods of Clinical and Personality Research** (3) Rice
Review of techniques especially relevant to research in clinical, personality, and social psychology. Scaling methods, multivariate techniques, introduction to the use of computers in data analysis. Prerequisite: Psyc 202; Stat 105 or equivalent. (Spring, odd years)

207–8 **Psychological Assessment** (3–3) Holmstrom, Levy, Silber, Meltzer
Open only to clinical graduate students in the Department of Psychology. Theoretical and clinical aspects of assessment; includes interviewing, psychometric tests, and projective techniques. Two-hour laboratory—diagnostic work at clinical facilities. Material fee, $10 per semester. (Academic year)

209 **Seminar: Psychology of Motivation** (3) Caldwell
Various theoretical approaches to the psychology of motivation systematic concepts and experimental findings deriving from each approach. (Spring)

211 **Assessment of Cognitive Functioning** (3) Levy
Concepts of intelligence and achievement and their assessment through a variety of individual procedures. Material fee, $10. Admission by permission of instructor. (Summer)

212 **Personality Assessment by Projective Techniques** (3) Levy
Methods of personality assessment, primarily the Rorschach. Material fee, $10. Admission by permission of instructor. (Summer)

213–14 **Seminar: Developmental Psychology** (3–3) Abravanel, Brandt, Walk
Psyc 213: research and theory in developmental psychology, emphasis on perceptual and cognitive development; consideration of the development of social awareness and of genetic-biological growth processes. Psyc 214: current research and theory in perceptual, cognitive, and social development; intensive study of selected research problems. (Academic year)

215 **Personality Assessment by Multiple Procedures** (3) Brandt
Consideration and use of a wide range of procedures in assessment of personality and psychopathology of children. Prerequisite: Psyc 207–8 or 211 and 212. Graduate students in fields other than psychology admitted by permission of instructor. Material fee, $10.

216 **Psychological Assessment by Graphic Means** (3) Levy
Examination of graphic procedures for assessment of intelligence and personality; clinical use and evidence of validity. Common interpretive principles sought. Human figure drawings and free paintings as examples. Admission by permission of instructor. (Fall)

218 **Seminar: Systems of Psychotherapy** (3) Silber
Introduction to theory and technique of psychotherapeutic ap-

proaches: psychoanalytic, ego-centered, nondirective, transactional, and others. Original sources surveyed. (Summer)

219 **Group Dynamics** (3) Miller
Relationship of the individual to groups, collectivities, and larger social systems. Theory, research, and applications of group and organizational processes, emphasizing contributions of Freud, Bion, Slater, Miller and Rice. Opportunity is provided to attend a group dynamics workshop, which is recommended but not required. Enrollment limited. (Spring)

220 **Seminar: Abnormal Psychology** (3) Miller
Study of selected problems of psychopathology. (Fall)

221–22 **Seminar: Group Psychotherapy** (3–3) Borriello
For graduate students in the clinical psychology program. Open to others if space permits and with permission of instructor. Psyc 221: survey of group therapy approaches; Psyc 222: supervised experience with therapeutic groups. Prerequisite to Psyc 221: Psyc 219. (Academic year)

223 **Seminar: Learning** (3) Hashtroudi
Selected topics of current research interest in the psychology of learning. (Spring)

225 **Seminar: Child Psychotherapy** (3) Staff
Theory and practice of insight-oriented psychotherapy with children. Class observation of an ongoing treatment case. Supervised treatment of a child in a practicum setting. Permission of instructor required for all students except graduate students in the child clinical track. (Spring)

226 **Seminar: Clinical Psychology of Childhood and Adolescence** (3) Brandt
For graduate students in psychology; open to others with permission of instructor, if space permits. Exploration of major topics concerning psychopathology in children and adolescents; discussion of nosological issues with emphasis on theoretical and research literature.

227–28 **Seminar: Principles of Psychotherapy** (3–3) Kahn
For graduate students in clinical psychology; open to others, with permission of instructor, only if space permits. Patient's needs and demands on the therapist. Case participation heavily relied upon. Prerequisite: Psyc 218. (Academic year)

229 **Seminar: Principles of Behavior Change** (3) Phillips
Stimulus-organism-response variables and their interactions, with emphasis on learning theory as applied to clinical problems. (Fall)

231 **Development of Psychometric Instruments** (3) Mosél
Quantitative techniques and principles used in construction, standardization, and evaluation of personality and ability measures for research and practice; quantification of human judgment for measurement purposes. Prerequisite: course in tests and measurements and an elementary course in statistics. (Fall)

232 **Ego Psychology and Theories of Object Relations** (3) Holmstrom
Emphasis on theoretical contributions of Freud, Hartmann, Kris, Klein, Rapaport, Kernberg, and others. Assessment and treatment are addressed, primarily with reference to investigations of borderline and characterological disorders. Permission of instructor required for all students except those in clinical psychology. (Spring)

234 **Seminar: Theory of Psychological Measurement** (3) Mosél
Development of classical axiomatic-deductive theory underlying ma-

jor notions in the construction and evaluation of psychological tests. (Spring)

235 **Seminar: Community Mental Health** (3) Miller
For graduate students in the Department of Psychology; open to others, with permission of instructor, only if space permits. Survey of issues and techniques in community mental health; emphasis on educational systems and community mental health issues. Prerequisite: Psyc 219. (Fall)

237–38 **The Practice of General Psychology** (3–3) Meltzer
Application of psychological principles and findings to a wide spectrum of human problems. Professional issues facing the psychologist offering services. Participation in the development, implementation and evaluation of applied psychological services and projects. (Academic year)

240 **Seminar: Selected Topics in Psychopathology** (3) Silber
Examination of current research and theory in psychopathology. (Spring)

241–42 **Family Systems: Theory, Practice, and Research** (3–3) Staff
Family dynamics and their implications for assessment and treatment. Special emphasis on the role of research in the process of evaluation of family systems and family therapy. Enrollment limited to advanced doctoral students in clinical psychology. (Academic year)

243 **Psychoanalytic Theory and Research** (3) Miller
An introduction to classical and modern psychoanalytic theory and research. A review of Freud's central works, focusing on his case studies and their role in theory development. Emphasis on instinct theory, with comparisons to contemporary studies of dreams, infant observation, male and female personality development, psychopathology, and related topics.

244 **Theories and Processes of Organizational Management** (3)
Basic functions and techniques of organizational management—design, control, direction, and decision-making—examined from the viewpoint of behavioral science. Mosél

245 **Seminar: Organizational Behavior** (3)
Analysis of organizational behavior; emphasis on motivation and productivity. Recent research on employee attitudes, primary group supervisory leadership, formal and informal organization, job design. (Fall)

246 **Seminar: Personnel Evaluation Techniques** (3) Mosél, Harper
Techniques of personnel selection and performance evaluation. Employment tests, personal data, assessment interviews, performance ratings, and assessment centers. Consideration of federal guidelines in employee selection. Includes practicum.

248 **Organizational Behavior Research Applied to Organizational Intervention and Change** (3) Cohen
Emphasis on development of models of organizational effectiveness, design of valid diagnostic instruments; implementation of research strategies; establishment of program-evaluation criteria. (Spring, even years)

249 **Organizational Behavior Modification** (3) Mosel
Application of operant and other experimentally derived principles to changing individual and group performance in organizations. Contingency management and organizational development. New approaches to intrinsic job motivation based on covert reinforcement theory. (Spring—alternate years)

250 Human Resources Development (3)
An examination within a psychological systems perspective of the requirements for integrating employee assessment, placement, training, and motivation modules into a unified human resources development program. Emphasis on models and techniques of organizational development and the utilization of key organizational factors to determine content of the program.

251 Seminar: Advanced Social Psychology (3) Tuthill, Poppen, Green
Current research and theory: motivation and cognition, dissonance, social interaction theory, interpersonal processes, group dynamics, group conflict. (Fall)

252 Research Methods in Social Psychology (3) Tuthill, Poppen, White, Green
Selected methods such as public opinion polling, attitude scaling, interviewing, content analysis, naturalistic observation, field research or laboratory experimentation. May be repeated for credit. (Fall and spring)

254 Seminar: Experimental Social Psychology (3) Tuthill
Experimental study of small groups, group climates, interaction process analysis. Lewin's field-theoretical approach to individual and group processes. (Spring, odd years)

257 Current Topics in Social Psychology (3) Poppen, Green
Advanced seminar with focus on major theoretical approaches, research, or problem areas within field of social psychology. Topic changes each semester. (Fall and spring)

258 Seminar: Attitude Change (3) Tuthill
Review of recent research literature on attitude formation and change. Examination of theories of attitude change and experimental findings. (Spring, even years)

263 Evaluation Research (3) Rice
Research issues and methods in evaluating the impact of social intervention and service programs, especially those in mental health. Specification of program goals and effectiveness criteria; measurement problems; experimental and quasi-experimental designs; political problems surrounding evaluation research. (Spring, even years)

268 Seminar: Neuropsychology (3) Rothblat
Selected problems in research relating the brain and behavior. Independent topics each semester such as sensory processing, brain development and behavior, clinical aspects of nervous system function.

272 Seminar: Theories of Personality (3) Caldwell
Emphasis on theoretical problems and methodology in the field of personality study. (Fall, odd years)

274 Comparative Psychology and Ethology (3) Caldwell
Synthesis of the principles and findings of ethology and comparative psychology. Examination of the theories and findings of Lorenz, Tinbergen, and Jakob von Uexküll in the light of recent experimental investigations. (Fall, even years)

281 Clinical Neuropsychology I (3) Rothblat
Analysis of experimental and clinical findings from studies attempting to localize and interpret human brain dysfunction, with emphasis on perceptual and cognitive behavior. Topics include overviews of neuroanatomy and neurological techniques, clinical description and theoretical consideration of major neuropsychological disorders,

mechanisms underlying recovery of function and potential for rehabilitation. Graduate students in fields other than psychology admitted by permission of the instructor.

282 **Clinical Neuropsychology II** (3) Levy
Examination of important psychological procedures for the assessment of human brain dysfunction. Instruments and batteries such as the Bender-Gestalt, Wechsler Adult Intelligence Scale, Halstead-Reitan Neuropsychological Battery, and Luria's Neuropsychological Tests. Prerequisite: Psyc 211, 212, 281, and permission of the instructor.

289 **Seminar: Current Topics in Experimental Psychology** (3) Staff
Review and discussion of contemporary research and theory in a specialized field of psychological study, by leaders in the field. Independent topics each semester; may be repeated for credit. (Fall and spring)

291 **Theories of Organizational Behavior** (3) Cohen
Examination of current theoretical models and research. (Spring, odd years)

292 **Seminar: Perception** (3) Walk
Study of current research and theory in the experimental psychology of perception and perceptual development. (Spring)

295 **Independent Research in Psychology** (3) Staff
Individual library or experimental research under supervision of staff member. Arrangements must be made with sponsoring faculty member prior to registration. May be repeated for credit. (Fall and spring)

299–300 **Thesis Research** (3–3) Staff
(Fall and spring)

Fourth Group

398 **Advanced Reading and Research** (arr.) Staff
Limited to students preparing for the Doctor of Philosophy major field examination. May be repeated for credit. (Fall and spring)

399 **Dissertation Research** (arr.) Staff
Limited to Doctor of Philosophy candidates. May be repeated for credit. (Fall and spring)

PUBLIC ADMINISTRATION—GRADUATE PROGRAMS

Professors D.S. Brown, W. Sommers *(Emeritus)*, S.R. Chitwood, M.M. Harmon, N. Beckman
Professorial Lecturers H.M. West III, B.T. Pitsvada
Associate Professors B.L. Catron, A.E. Merget *(Chairman)*, S.J. Tolchin, C.W. Washington, L.H. Truong, W.C. Adams
Assistant Professor K. Newcomer

Programs of study in Public Administration leading to the degrees of Master of Public Administration and Doctor of Public Administration are offered by the School of Government and Business Administration (see pages 131–62).

Third Group

205 **Introduction to Public Administration and Management** (3) Brown, Harmon, Truong
Provides frame of reference for study of public administration. Historical development, contemporary approaches, roles of the pub-

lic manager. Ethics and norms, administrative responsibility and public interest. Management in the public sector. (Fall and spring)

212 **Legislative Management** (3) Tolchin
Analysis of Congress as a management system; examination of its internal administration and its role in formulating policy through legislation. Executive-legislative relationships, staffing practices, budget processes, leadership, rules and procedures, oversight functions, and the management of foreign policy are examined. (Fall)

213 **Administration in the Federal Government** (3) Tolchin
Critical analysis of the structure and administration of the federal government from both a managerial and political perspective. Emphasis on executive branch organization, integration, and coordination, as well as current trends in government regulation, accountability, and effectiveness. (Fall and spring)

215 **Law and the Public Administrator** (3) Chitwood
Exploration and analysis of the functions of law in a democratic society. Emphasis is placed upon the procedural, historical and jurisprudential dimensions of American law. This broad perspective seeks to convey understanding of the law as a legal and moral force guiding and constraining public decision making. (Spring)

216 **Federal Government Regulation of Society** (3) Tolchin
Analysis of the federal regulatory process as it affects the public and private sector. Specific problems involving presidential management, systemic failures, dejudicializing the regulatory process, policy conflicts, reform efforts, legislative oversight, and economic deregulation. Emphasis is placed on new solutions. Same as BAd 216. (Spring)

217 **Seminar: Development Administration I** (3) Truong
The nature of underdevelopment. Specific problems of less developed countries. National cultures and political and administrative systems. The giving of assistance: types of foreign aid; problems of working with aid givers. (Fall)

218 **Seminar: Development Administration II** (3) Truong, Brown
Problem of the transfer of administrative capability from one country to another. Political and administrative development. Unilateral and multilateral approaches. The role of the innovator. Strategies of administrative development. (Spring)

221 **Organization Theory and the Public Sector** (3) Catron, Harmon, Washington
Analysis of organization theory with special focus on public organizations; current issues in organization theory; decision-making, the organizational environment and the changing nature of organizations in a post-industrial society. (Fall and spring)

223 **Behavioral Factors in Large and Complex Organizations** (3) Brown
Analysis of the nature and characteristics of large organizations. Bureaucracies and their behavioral patterns; dysfunctionalism. Approaches to policy guidance and leadership, particularly in large public organizations; influence and control systems. Future trends. (Fall and spring)

224 **Managerial Leadership in Complex Organizations** (3) Brown
What the manager must know and do to provide leadership and guidance in large, complex public organizations. Subjects explored include program planning and the supervision and direction of staff so as to achieve organizational objectives.

231 **Public Personnel Administration** (3) Truong
Basic principles, legislative and judicial background, and currently

significant practices in personnel administration in the public service. Roles of recruitment, selection, wage and salary administration, employee development, and other personnel functions. (Fall) Sommers, Truono

232 **Current Issues in Public Personnel Management** (3)
Analysis of major personnel management problems in government labor-management relations, affirmative action for equal employment opportunity, impact of legislation and court decisions on trends in personnel policies, and other continuing problems. (Spring) West

233 **Seminar: Manpower Planning, Development, and Utilization** (3)
Examination of public and private manpower trends, problems, policies, and programs. Exploration of approaches to the analysis and administration of manpower programs. Analysis of impact of economic, political, and social factors on manpower. (Fall)

235 **Seminar: Technology Change and Professional Human Resource Planning** (3) Frame, Roma
Addresses human resource problems arising from automation and other technological changes. Evaluation of these developments in government, business, and educational organizations, and their implications for productivity, employment, training, and educatio Analysis of economic, political, and social factors influencing public and private human resource policies. (Spring)

236 **Labor-Management Relations in the Public Sector** (3) Staff
Principles and current issues in public sector labor relations; collective bargaining and the merit concept, scope of bargaining, representation elections, unfair practices, grievance procedures, bilateralism and the management process.

242 **Administration of State and Local Governments** (3) Washington
Examination of state and local governmental structures and functions, their place within the federal system, their revenue sources, their limitations, and the alternatives available to encourage more effective administration to meet public and private demands. (Fall and spring)

245 **Intergovernmental Relations** (3) Beckman, Washington
Assessment of the impacts and consequences of changes in the administration of intergovernmental policies and programs in the federal system. Legislation, roles and responsibilities of federal, state, regional and local systems will be examined from both theoretical and practical vantage points.

246 **Dynamics of Citizen Participation in Administration** (3) Taylor, Merget
Review of the basic theory and principles of democracy in the American system of governance. Analysis of the nature of participation in a pluralistic society, including the characteristics and dynamics of citizen-based organizations. Exploration of effective methods or models by which citizens may contribute to administration (Summer) Merget

248 **Financing Local Government** (3)
Analysis of the theory and practice of public finance in local governments. Includes the financing of services through municipal taxation, intergovernmental funds, debt instruments, and other revenue sources. (Spring) Washington

249 **Urban Public Policy** (3)
Examination of selected national policies and their effects on urba

areas and governments. Emphasis on policy dimensions of urban systems and their relationship to the social, political, and economic context. Against the background of urban politics and administration, areas of health, education, welfare, manpower, transportation, and housing will be addressed. (Spring)

251 **Governmental Budgeting** (3) Merget, Pitsvada
Survey of the basic concepts, principles and practices in governmental budgeting; interrelationship of planning, programming, and budgeting; their role in the management process. (Fall and spring)

252 **Public Expenditure Analysis and Planning** (3) Merget
Intensive analysis of the concepts and principles of economics as applied to the public sector and the analytic techniques used by government agencies for planning, allocating, and managing scarce resources in the implementation of public programs. Topics discussed include benefit-cost analysis, program budgeting, productivity, and performance measurement. (Fall and spring)

253 **Public Financial Management Within Federal Agencies** (3) Staff
Intensive analysis of the concepts, principles, and general practices of financial management within federal departments and agencies, focusing on the interrelationships of financial and program functions and drawing on the several financial disciplines of budgeting, accounting, and auditing. (Spring)

260 **Policy Formulation and Administration** (3) Harmon, Tolchin
Normative, analytical, and decision-making models of the policy process; impact of economic and political factors on public policy formulation and implementation. (Fall and spring)

261 **Policy Analysis in Public Administration** (3) Catron, Newcomer
Concepts and issues in public policy analysis. Theoretical problems encountered in policy analysis. The role and limits of analytic techniques in the development, implementation, and evaluation of public policy. (Fall and spring)

262 **Seminar: Science, Technology, and Public Policy** (3) Black
The impact of science and technology upon public administration in terms of both administrative practice and national policies. (Spring)

264 **Public Program Evaluation** (3) Newcomer
Theory and practice of program evaluation and evaluative research. Exploration of scope and limitations of current practice in evaluation, considering economic, political, social, and administrative factors. Examination of methodological considerations for design, data collection, analysis, and dissemination. (Spring)

267 **Cases in Public Policy** (3) Catron
Critical analysis of topical issues in public policy, using a case-study approach. Specific issues covered will vary. Designed principally for MPA students in the last half of their program. Prerequisite: PAd 260 or 261, 295, or permission of instructor. (Fall)

279 **Purchasing and Materials Management** (3) Sherman
Same as BAd 279.

280 **Procurement and Contracting** (3) Sherman
Same as BAd 280.

282 **Government Contract Administration** (3) Sherman
Same as BAd 282.

283 **Pricing and Negotiation** (3) Sherman
Same as BAd 283.

285 **Systems Procurement and Project Management** (3) Sherman
Same as BAd 285.

288 **Field Problem Studies in Public Administration** (3) Staff
Field research and approved internships on selected issues and aspects of public administration, including specific policy and management problems arising in governmental agencies and related public institutions. Open to Masters students upon completion of 9 hours toward the degree program and with the consent of the intern coordinator. (Fall and spring)

289 **Public Program Management and Policy Implementation** (3) Staff
A review of the diverse concepts and methods in public administration; an analysis and integration of the salient political, economic, managerial, and leadership values and issues in implementing public policies. Open only to MPA degree candidates in their final semester of study; serves as a capstone seminar to the MPA program. (Fall and spring)

290 **Special Topics in Public Administration** (3) Staff
Experimental course offering; new course topics and teaching methods. May be repeated once for credit.

295 **Research Methods** (3) Adams, Newcomer
Theory and practice in research methodology. Data sources and gathering, research models and designs. Critical evaluation of research studies. Emphasis on application of research methods to policy questions. (Fall and spring)

296 **Statistical Applications in Public Administration** (3) Adams, Newcomer
Use of statistics, computers, and SPSS in research and program evaluations. Emphasis on interpretation and use of statistics. Development of basic statistical competency; frequency distribution, sampling, central tendency, variability, correlation, probability, regression; computer assistance. Prerequisite: PAd 295 or permission of instructor. (Fall and spring)

298 **Directed Readings and Research in Public Administration** (3) Staff
Supervised reading in selected fields within public administration. Admission by permission of instructor. May be repeated once for credit.

299 **Thesis Seminar** (3) Staff
Examination of thesis standards, research philosophy and methodology in public administration.

300 **Thesis Research** (3)

Fourth Group

Fourth-group courses are primarily for doctoral students, and are offered as the demand requires. They are open to other graduate students at the discretion of the department or the instructor. Staff

311–12 **Seminar: Public-Private Sector Institutions and Relationships** (3–3)
An analysis and critique of alternative theoretical frameworks for describing, understanding, and predicting the nature, values, and interactions of American public and private institutions. Problems, potentials, and alternatives for structuring public and private institutional arrangements to meet the needs of society. Brown

323 **Seminar: The Large and Complex Organization** (3)
Unique problems of large, complex organizations: public, private, and mixed. Emerging concepts and theories. Selected issues.

373 Seminar: Public Administration and American Political and Social Institutions (3) Merget, Washington
Supervised in-depth study of contemporary literature in selected fields and of research methodology in public administration.

374 Seminar: Trends in Public Administration Theory (3) Harmon
Survey of contemporary normative and epistemological issues in public administration theory and practice. Analysis of the past and present influence of logical positivism, behavioralism, humanism, existentialism and phenomenology.

377 Seminar: Social Action and Public Policy (3) Catron
Interdisciplinary approach to foundations of public policy with focus on theoretical problems of social action. Interrelation of theory and practice. Decision and management as human actions.

398 Advanced Reading and Research (arr.) Staff
Limited to students preparing for the Doctor of Public Administration general examination. May be repeated for credit.

399 Dissertation Research (arr.) Staff
Limited to Doctor of Public Administration candidates. May be repeated for credit.

RADIOLOGICAL SCIENCES—GRADUATE PROGRAMS

Committee on Radiological Sciences

W.C. Eckelman *(Chairman)*, V.H. Cohn, J.B. Levy, R.C. Reba, S.O. Schiff

The Graduate School of Arts and Sciences offers an interdepartmental program leading to the degrees of Master of Science and Doctor of Philosophy in the field of radiological sciences. The program is directed by a committee whose members are drawn from the Departments of Radiology, Pharmacology, Chemistry, and Biological Sciences.

Applicants should have a baccalaureate degree in chemistry, physics, pharmacy, or the biological sciences. Graduate Record Examinations are required for Ph.D. degree applicants and recommended for M.S. applicants. The undergraduate program must have included two semesters each of organic chemistry, physical chemistry, and general biology, and one semester of quantitative analysis.

Master of Science in the field of radiological sciences—Required: the general requirements, pages 89–96. The 40 semester hours required for this program must include: Rad 190; Bioc 221–22; Phyl 191; Stat 127; RSci 201, 220, 221, 230, 240, and 241; Phar 203; and six hours of RSci 299–300.

Doctor of Philosophy in the field of radiological sciences—Required: the general requirements, pages 89–91, 96–99. The program of study must include: Rad 190; Bioc 221–22; Phyl 191; Stat 127; RSci 201, 220, 221, 230, 240, 241, and 250; Chem 235 and 236; and Phar 203. The tool requirements may be met by the satisfactory completion of an approved course in statistics other than Stat 127 and one foreign language or a course in computer programming.

RADIOLOGICAL SCIENCES

201 Nuclear- and Radio-chemistry (3)
An introduction to the structure of matter and radioactive decay. Covers concepts of radioactive decay and growth, interaction of radiation with matter, radiation detection and measurement, statis-

tical considerations, tracers in chemical applications, radioactive decay processes, and nuclear models.

220 **Radiopharmaceuticals** (3)
An introduction to the chemistry and mechanism of action of radiolabeled tracers used in clinical nuclear medicine including the chemistry of technetium, indium, and the halogens and radiopharmaceuticals for specific organs and organ systems such as lung, bone, bone marrow, heart, kidney, and liver.

221 **Preparation of Radiopharmaceuticals** (1)
A laboratory course taught in conjunction with RSci 220, involving the preparation of radiopharmaceutical kits used in clinical nuclear medicine.

230 **Radioimmunoassay** (2)
A review of the current methods used in radioreceptor assay and radioimmunoassay. Topics covered include iodination, antisera preparation, separation of bound from free antigen, solid-phase antibody systems, methods involving labeled antibodies, extraction and concentration of hormones from physiological fluids, and mathematical treatment of data and automation.

240 **Chromatographic Techniques** (3)
An introduction to separation sciences with emphasis on separation equilibria, diffusion and mass transport, operational aspects of separation, chromatography, characteristics of individual separation methods distillation, gas-liquid chromatography, solvent extraction, liquid-liquid chromatography, crystallization, ion-exchange separation processes, liquid-solid adsorption chromatography, and quality assurance

241 **Laboratory: Chromatographic Techniques and Quality Assurance** (1)
Laboratory to accompany RSci 240.

250 **Seminar in Radiopharmaceutical Chemistry** (1)
Invited lectures by research groups in radiopharmaceutical chemistry. Staff

260 **Special Topics in Radiological Sciences** (2 or 3)
Selected aspects of radiopharmaceutical chemistry. Content differs each time the course is offered. Emphasis on the chemistry of radionuclides at low concentrations.

299–300 **Thesis Research** (3–3)
(Fall and spring)

399 **Dissertation Research** (arr.)
May be repeated for credit.

CHEMISTRY

221 *Advanced Analytical Chemistry I* (3)
222 *Advanced Analytical Chemistry II* (2 or 3)
233 *Organometallic Chemistry* (3)
235–36 *Advanced Inorganic Chemistry* (3–3)
251–52 *Advanced Organic Chemistry* (3–3)
257 *Physical-Organic Chemistry* (3)
258 *Synthesis and Structure Determination in Organic Chemistry* (3)

PHYSIOLOGY

191 *Selected Topics in Human Structure and Function* (3)
201 *Physiology* (8)

PHARMACOLOGY

203 *Fundamental Principles of Pharmacology and Toxicology* (3)
256 *Molecular Pharmacology* (2 or 3)
258 *Cancer Chemotherapy* (1)
260 *Endocrine Pharmacology* (1)
269 *Pharmacology Seminar* (1)
275–76 *Advanced Topics in Pharmacology I-II* (1–1)
277–78 *Advanced Topics in Pharmacology III-IV* (1–1)

BIOLOGY

167 *Radiation Biology* (3)
206 *Seminar: Radiation Biology* (3)

BIOCHEMISTRY

221–22 *General Biochemistry* (3–4)

STATISTICS

127 *Statistics for the Biological Sciences* (3)

RELIGION

Professors R.G. Jones, H.E. Yeide, Jr. *(Chairman)*, D.D. Wallace, Jr., A.J. Hiltebeitel
Associate Professor D.A. Altshuler
Associate Professorial Lecturers E.S. Jospe, M.L. Gross
Assistant Professor S.A. Quitslund

Bachelor of Arts with a major in religion (departmental)—The following requirements must be fulfilled:

1. The general requirements as stated on pages 71–72, 79–85. (Students should consult the departmental advisor regarding courses to be taken to satisfy the requirements for meaningful initiation into the social sciences and the natural and mathematical sciences.)
2. Prerequisite courses—six hours from among Rel 9, 10, 59, 60.
3. Four required courses in related areas—(a) six semester hours in studies of cultures other than American and English (preferably a foreign language), and (b) six semester hours in either literature, philosophy, or history.
4. Required courses in the major—thirty semester hours including at least twenty-one hours of upper-level courses. Twelve of these hours must be chosen from one of the following religious traditions: Judaism (Rel 103, 107, 113, 114, 115, 116, 174, 184), Christianity (Rel 104, 105, 122, 124, 143, 144, 145, 146, 172), religions of India (Rel 157, 158, 159, 160, 162). Appropriate graduate seminars may be approved as substitutions for advanced-level courses. The program must include Rel 101 and at least one course in each of the following areas: Hebrew Scriptures, New Testament, Eastern religions, Western religions.

An honors thesis course (Rel 191) is available for eligible students.

It is recommended that students include the study of foreign languages in their undergraduate program, including Hebrew for those specializing in Judaism and biblical studies, Greek for those specializing in early Christianity (including the New Testament), Sanskrit for those specializing in the religions of India. All students expecting to enter graduate school are urged to study French or German.

Minor in religion—Required: a minimum of 18 semester hours in religion, of which at least 6 must be upper-level courses. The minor program will be developed in consultation with the departmental advisor. Rel 101 is recommended for all participating students.

Master of Arts in the field of religion—Prerequisite: the degree of Bachelor of Arts with a major in religion from this University, or an equivalent degree.

Required: the general requirements, pages 89–96. Of the 24 semester hours of required courses (exclusive of the thesis), at least 12 must be in third-group religion courses; a maximum of nine may be in a closely related field outside the Department of Religion as approved by the department. The Master's Comprehensive Examination must cover three fields (the thesis research must be on one of these three fields) selected from the following: the Old Testament, the New Testament, history of Christianity, Judaism, history of religion in America, modern religious thought, ethics, sociology of religion, and history of religions. A reading knowledge examination, usually in French or German, is required; however, Hebrew or Greek is acceptable for those students whose thesis area is in the Biblical field and Sanskrit or an Eastern language for those whose thesis area is in the history of religions.

Master of Arts in the field of religious education—Prerequisite: the degree of Bachelor of Arts with a major in religion from this University, or an equivalent degree. The undergraduate program should have included the following courses or equivalent: Anth 2; Educ 108; Psyc 1, 22, and 29; SpDr 1 or 11.

Required: the general requirements, pages 89–96. Of the 24 semester hours of required courses (exclusive of the thesis), at least six must be in third-group religion courses; a maximum of 12 may be in a closely related field outside the Department of Religion as approved by the department.

Master of Arts in the field of religion and medical care—Prerequisite: (1) the degree of Bachelor of Arts with a major in religion from this University, or an equivalent degree; (2) a first professional theological degree; or (3) acceptable academic work required of entering medical students who have not earned a bachelor's degree, but who are pursuing the degree of Doctor of Medicine. Certain courses in this program are offered only through off-campus centers of the Division of Continuing Education and Summer Sessions.

Required: the general requirements, pages 89–96. The program of study consists of 36 semester hours of approved course work with or without a thesis. Students must elect course work covering four fields selected from clinical pastoral care, religion, sociology, psychology, health care administration and medicine. The course work in these fields must be distributed as follows: 12 semester hours each selected from two fields and at least six hours in clinical pastoral care. The Master's Comprehensive Examination must cover three fields selected from the list above, one of which, as approved by the department, must be outside of the Department of Religion. Supervised clinical education may be offered as a tool subject in lieu of the required reading knowledge examination in a foreign language.

Master of Arts in the field of history of religions—Hinduism—(Consortium of Universities program). Prerequisite: the Bachelor of Arts degree from this University with suitable background in the study of religion of South Asia or an equivalent degree.

Required: the general requirements, pages 89–96. The program of study consists of 24 hours of course work (exclusive of thesis) selected from upper-division and graduate courses of member universities of the Consortium as determined by the Department of Religion, including a sequence of four courses in the literature of the Hindu tradition and one course in method in history of religions. The Master's Comprehensive Examination must cover the following: methods in the study of religions, thematic comparisons between the Hindu

tradition and at least two other religious traditions, including at least one Western tradition, and a special field in Hindu tradition. A reading knowledge examination in a foreign language, usually in French or German, will be required, and a student must take at least two semesters of either Sanskrit or Hindi in addition to the 30 hours of required courses for graduate credit. More complete information regarding courses and requirements is available from the program advisor, Professor A. J. Hiltebeitel, Department of Religion.

Doctor of Philosophy in the field of American religious history (offered in cooperation with the Department of History)—Required: the general requirements, pages 89–91, 96–99. The General Examination must cover four fields, including two from the Department of Religion (history of religion in America and either early Christianity or European Christianity since 1500) and two from the Department of History (generally American social history and one other).

First Group

9 The Hebrew Scriptures (3) **Jones**
Historical and literary study of the Hebrew Scriptures (Old Testament) with consideration of development of religious ideas, institutions, and outstanding personalities. (Fall and spring)

10 The New Testament (3) **Jones**
Study of New Testament literature from the standpoint of occasion, purpose, dominant ideas, and permanent values. Emphasis on approach, structure, and significance of the Gospels and Epistles. (Fall and spring)

21 Religion and the Human Search for Meaning (3) **Yeide**
Traditional religious concepts, language of contemporary religion amidst modern scientific and secular intellectual tendencies, and the place of religion in today's society. (Fall)

22 Religion and Contemporary Social Issues (3) **Yeide**
Illumination of social problems by ethical reflection; examination of religious perspectives as stimuli and barriers to social change; techniques for maintaining social values and seeking change. (Spring)

23 Judaism: Identities and Ideas (3) **Altshuler**
Exploration of important practices and beliefs in classical and modern times; study of people and texts that confront tradition and background. (Fall and spring)

41 Roots of the Western Tradition (3) **Staff**
Same as Clas/Engl/Hist/Phil 41. Basic ideas of western thought from early Greek, Roman, Judaic, and Christian traditions. Representative readings in drama, epic, historical writings, oratory, creation stories, scriptural traditions, philosophy, and spiritual autobiography. To be taken in conjunction with Engl 13. (Spring)

59 Religions of the East (3) **Hiltebeitel**
Origins, evolution, and contemporary status in historical context of primitive religions, Hinduism, Buddhism, Taoism, Confucianism, and Shinto. (Fall and spring)

60 Religions of the West and Near East (3) **Wallace**
History of religion in the ancient world (e.g., Greece) and of Judaism, Christianity, and Islam, including modern developments. (Fall and spring)

*91 **East Asia—Past and Present** (3) Johnson and Associated Faculty
An interdisciplinary course, introducing the student to a comprehen-

* An interdepartmental course offered by the Departments of Religion, East Asian Languages and Literatures, Economics, Geography and Regional Science, History, Philosophy, and Political Science.

sive and integrated understanding of the civilization and present problems of East Asia.

Second Group

101 Theories in the Study of Religion (3) Staff
Seminar taught jointly by the faculty of the Department of Religion. Analysis of different ways in which religious phenomena can be approached. Readings and discussion of some of the epoch-making books in the development of the study of religion. (Fall)

103 The Prophets (3) Quitslund
Development of the prophetic movement in Israel; cultural, economic, literary, and religious dimensions; elements of lasting value in the prophetic teaching. Study of selected prophets. (Fall)

104 The Life and Thought of Jesus (3) Quitslund
Comprehensive study of the life and teachings of Jesus with critical attention to sources. Quest for the historical Jesus. (Spring)

105 The Life and Thought of Paul (3) Quitslund
Backgrounds of early Christianity, first-century religious and social conditions affecting the spread of Christianity, the life and journeys of Paul, Paul's presentation of the Christian faith. (Spring)

107 Rabbinic Literature and Thought (3) Altshuler
Readings of the Mishna, Tosefta, Talmuds, midrashim, and liturgical works in English translation. Methods of literary and historical analysis introduced and applied. Individual research projects. (Fall)

111 Myth, Epic, and Novel (3) Hiltebeitel
Religious themes and images of the hero and their cultural significance in literature: e.g., Indo-European, Biblical, Babylonian narrative traditions; Greek epic and drama; Dante, Milton, Dostoevsky, Kafka, Hesse, Faulkner, Beckett.

113 Early Post-Biblical Judaism (3) Altshuler
History of Judaism from the time of Ezra through the destruction of Jerusalem in 70 CE—canonization of the Pentateuch, Hellenism, Maccabean revolt, growth of sectarian movements, Herod, ferment against Rome in context of Eastern and Western political currents. Use of primary sources, especially the Bible, Josephus, and rabbinic and noncanonical writings.

114 Judaism in the Rabbinic Period (3) Altshuler
From 70 CE through end of rabbinic period. Focus on religious responses to destruction of the Temple; apocalyptic thinking and revolt of Bar Cochba; rabbinic and patriarchal responses to Roman authority; Tannaitic and Amoraic Judaism in Palestine and Babylonia mystical and folk religion phenomena preserved in art and literature

115 Judaism in the Medieval World (3) Altshuler
History of relations between Jews and non-Jews. Daily life and education of the ordinary Jew; rabbinical law and interpretation of scripture; Jewish philosophers, mystics, sects and messianic movements. (Fall)

116 Judaism after Emancipation (3) Altshuler
Transformation of community and beliefs among Jews beginning with catalyst of their political emancipation. Responses to beginnings of modernity among Jews in Europe, America, and Israel. (Spring)

122 Christian Ethics and Modern Society (3) Yeide
Nature and principles of Christian life as developed by the Christian

community; problems of personal conduct; application to family, social, and economic institutions. (Fall)

124 **Contemporary Movements in Theology** (3) Quitslund
Theological approach and systems of a selected number of modern theologians and/or theological movements such as process theology, liberation theology.

126 **Western Mysticism** (3) Quitslund
Study of the phenomenon of religious experience and of selected mystics in Judaism, Christianity, and Islam. (Spring)

127 **Medicine, Religion, and Healing** (1) Yeide
Total care concept. Importance of religion in medical practice for patient and physician. Concept of the professional, the clergy's role in healing, religious prespective on issues in medical ethics. (Spring)

137 **The Land of Israel and the Growth of the Western Religions** (6) Staff

143 **Early Christianity and the Spiritual Life of the Ancient World** (3) Wallace
Rise and development of Christianity in relation to the culture, philosophy, mystery religions, and general religious life of the Greco-Roman world to A.D. 500.

144 **Medieval Faith and Symbolism** (3) Wallace
Christian life and thought in the Middle Ages; mystics, saints, popes, and philosophers.

145 **Religious Currents in the Renaissance and Reformation** (3) Wallace
Transformation of Western man's understanding of his identity and destiny from the end of the Middle Ages to the Age of Reason. (Fall)

148 **Christianity in the Modern World** (3) Wallace
Changes in Christian life and thought since 1700 as seen in theology, literature, political life, and religious institutions. (Spring)

155 **Anthropological Approaches to Religion** (3) Simons, Wagner
Same as Anth 155.

157 **Indian Philosophy and Mysticism** (3) Hiltebeitel
Indian speculative and mystical traditions; late *Vedas*, *Upanishads*, *Bhagavad Gita*, Buddhist, and Hindu soteriological systems. (Fall)

158 **Ancient Indian Literature and Religion** (3) Hiltebeitel
Studies of foundational texts of Hinduism, especially *Rig Veda*, *Brahmanas*, *Mahabharata*, (including the *Bhagavad Gita*); attention to Hinduism's archaic and seminal themes. (Spring)

159 **Mythologies of India** (3) Hiltebeitel
The lore of Indian gods (Vedic, Puranic), heroes (epics), and holy men (Hindu, Buddhist, Jain, Tantric); ties with Indian caste, cult, cosmology, and spiritual ideals.

160 **Buddhism** (3) Hiltebeitel
Origin, development, and contemporary status of Buddhist life and thought; its impact on the Near East.

161 **Islam** (3) Gross
Origin, development, and contemporary status of Islamic life and thought; its impact on the Near East. (Spring)

162 **Symbolism in the History of Religions** (3) Hiltebeitel
Religious symbolism, myth, legend, and ritual in the religions of the world; various theoretical analyses. (Spring)

172 **Religion in American Culture** (3) Wallace
Growth of religious bodies and institutions in relation to American

culture, development of religious thought, and analysis of the contemporary religious scene. (Fall)

174 **American Judaism** (3) Altshuler
Religious thought and institutions with emphasis on contemporary Judaism. Mythic and ritual life of American Jews, including responses to Israel, diaspora, the Holocaust, family and community dynamics. (Spring)

181 **Women in Western Religion** (3) Quitslund
Historical, theological, and ethical investigation of the image and role of women in Judaism and Christianity; special consideration of the Biblical experience, the sexual qualifications for religious office, use of male-female images and languages, and contemporary issues. (Fall)

184 **The Thought of Martin Buber** (3) Jospe
Basic principles underlying the Life of Dialogue and application of those principles to all strata of life from interpersonal relationships to the religious realm.

191 **Senior Honors Thesis** (3) Staff
Required of and open only to undergraduate honors candidates in religion. (Fall and spring)

Third Group

209–10 **Seminar: Biblical Studies** (3–3) Jones
Main problems of Biblical literary, historical, and theological criticism. (Academic year)

213 **Seminar: Judaism in Late Antiquity** (3) Altshuler
Selected topics. (Spring)

*216 **Supervised Clinical Pastoral Education (I–A)** (6) Staff
Full-time program of clinical pastoral education in an approved center. Involvement in the responsibility for pastoral ministry is reviewed and evaluated in a peer-group context. Offered as the demand warrants.

*217 **Supervised Clinical Pastoral Education (I–B)** (6) Staff
Continuation of Rel 216 with emphasis on pastoral and personal identity, sustained pastoral relationships, and pastoral methods and skills. Offered as the demand warrants.

*218 **Supervised Clinical Pastoral Education (III–A)** (6) Staff
Responsibility in pastoral ministry is increased with emphasis on group work, interprofessional involvement, use of specific counseling methods, work with persons with special problems. Prerequisite: Rel 216 and 217; or equivalent. Offered as the demand warrants.

*219 **Supervised Clinical Pastoral Education (III–B)** (6) Staff
Continuation of Rel 218 with emphasis on examination and review of administrative procedures, design of pastoral programs, and development of pastoral theology. Offered as the demand warrants.

222 **Seminar: Ethics** (3) Yeide
Selected topics. (Spring)

*223 **Religious and Ethical Perspectives on Medical Problems** (3) Yeide
Religious and ethical questions in medical problems and medically related issues. Offered as the demand warrants.

*225 **The Dynamics of Ministering to the Young Adult** (3)
Conceptual models of development of young adults from late adoles-

* Offered through the Division of Continuing Education and Summer Sessions at off-campus centers for students in the master's degree program in the field of religion and medical care.

cence; special problems of educational and military experience, vocational choice, marriage and the family, and physical, intellectual, emotional, and religious development. Encounter experience with persons and groups. Offered as the demand warrants.

235 **Seminar: Roman Catholicism in the Modern World** (3) Quitslund
Important leaders and their ideas in selected developments since 1800—doctrinal, spiritual, biblical, liturgical, and ecumenical. Emphasis on 20th century. (Fall)

237 **Seminar: Theological Analysis** (3) Quitslund
Historical and topical study of the development of important ideas in such areas as Christology, ecclesiology, and death.

238 **Seminar: Contemporary Judaism** (3) Altshuler
Selected topics.

262 **Seminar: History of Eastern Religions** (3) Hiltebeitel
Selected topics. (Spring)

271 **Seminar: American Religious History to 1830** (3) Wallace
Religious thought and life during the Colonial and early National period. (Fall)

273 **Seminar: American Religious History since 1830** (3) Wallace
Religious thought and life from the Civil War to the present.

291–92 **Readings and Research** (3–3) Staff
Investigation of special problems. (Academic year)

299–300 **Thesis Research** (3–3) Staff
(Fall and spring)

ROMANCE LANGUAGES AND LITERATURES

Professors J.W. Robb, G.E. Mazzeo *(Chairman)*, J.A. Frey, J.F. Burks
Associate Professors M.A.B. Coffland, P.G. Sáenz, G. Ludlow, S.R. Barnett, I. Azar, J.M. Thibault
Assistant Professors G.P. Huvé, J.E. Hicks, M. Cruz-Sáenz

Bachelor of Arts with a field-of-study major in (1) French language and literature, (2) Spanish language and literature, (3) Spanish-American literature, or (4) any approved combination selected from two of the preceding fields—The following requirements must be fulfilled:

1. The general requirements as stated on pages 71–72, 79–85. (Students should consult the departmental advisor regarding courses to be taken in satisfying the requirements for meaningful initiation into the social sciences and the natural and mathematical sciences.)
2. Prerequisite courses—Fren 1–2, 3–4, 9–10, or equivalent; or Span 1–2, 3–4, 9–10, or equivalent.
3. Required introductory literature courses—Fren 51–52 or 91–92, or Span 51–52 or 91–92.
4. Required for the major:

There is no specific program of required courses. The student, however, is expected to demonstrate a knowledge of his or her field in breadth and depth by passing a comprehensive examination at the end of the senior year. A proseminar is required as follows: Fren 199–200 for French language and literature majors; Span 199–200 for Hispanic language and literature majors.

Minor in French or Hispanic languages and literatures—Required: 6 semester hours of French or Spanish 51–52 or 91–92; 12 additional hours selected from among French or Spanish courses numbered 9 and above.

Master of Arts in the fields of (1) French literature, (2) Spanish literature, (3) Spanish-American literature, or (4) an approved combination of Spanish and Spanish-American literatures—Prerequisite: the degree of Bachelor of Arts in the appropriate field from this University, or an equivalent degree.

Required: the general requirements, pages 89–96. The program of study consists of 24 semester hours of approved course work plus a thesis (equivalent to six semester hours), or, with the approval of the department, a student may elect a program of study consisting of 36 semester hours of approved course work without a thesis.

Doctor of Philosophy fields of study in Romance literatures—Required: the general requirements, pages 89–91, 96–99. There are four fields: French literature; Spanish literature; Spanish-American literature; and any approved combination of French, Spanish, or Spanish-American literature.

Bachelor of Arts in Education and Human Development with teaching fields in French and in Spanish—Prerequisite: the education curriculum, pages 111–12.

Required: the French option or the Spanish option and the professional courses listed on pages 115–16.

Placement Examinations: A student who has not been granted advanced standing and who wishes to continue in college the language begun in high school must take a placement examination before registration. Upon completion of the examination, assignment is made to the appropriate course.

FRENCH

Departmental prerequisite: Fren 3–4 or 6, or equivalent, is prerequisite to all courses in French, from Fren 9 and above, except for courses offered in English translation.

First Group

1–2 **First-year French** (3–3) Burks and Staff

A year course; credit toward a degree at this University given on completion of Fren 2. For beginners. Pronunciation, conversation, grammar, composition, readings. Oral practice in language laboratory. Laboratory fee, $17.50 per semester. (Fall and spring)

3–4 **Second-year French** (3–3) Thibault and Staff

A year course; credit toward a degree at this University given on completion of Fren 4. Conversation, grammar, composition, readings in modern French prose. Oral practice in language laboratory. Prerequisite: Fren 1–2. Laboratory fee, $17.50 per semester. (Fall and spring)

6 **Second-year French** (6) Thibault and Staff

Lecture (3 hours), discussion (3 hours). Intensive course which covers material of Fren 3–4. Prerequisite: Grade of *B* or better in Fren 2. Laboratory fee, $17.50. (Fall and spring)

9 **Contemporary French Conversation** (3) Huvé and Staff

Emphasis on self-expression in a controlled situation. Special attention to the acquisition and active use of a flexible vocabulary. Oral and written reports and exercises. Prerequisite: Fren 4 or equivalent. (Fall and spring)

10 French in Written Context (3) Huvé and Staff
Study of vocabulary and syntax. Discussion of texts, reports, compositions, and translations into French. Prerequisite: Fren 9 or equivalent. (Fall and spring)

49 French for Graduate Students (0) Burks and Staff
For graduate students preparing for reading examinations. No academic credit. Tuition is charged at the rate of three credit hours, plus University Center fee. (Fall and spring)

51–52 Survey of French Literature (3–3) Thibault, Frey
Readings in French literature from the Middle Ages to the present. Lectures, readings, and informal discussions. (Academic year)

60 Contemporary French Civilization (3) Ludlow
Study of contemporary France as seen through its cultural, political, economic and social life, its geography, language, population and character. Class lectures and discussion of texts supplemented by slides, films, tapes and records. Conducted in English. (Summer)

91–92 Analyse de texte (3–3) Thibault
Methodology and vocabulary of literary criticism; application of principles of *explication de texte* to selections from prose, drama, and poetry from the Renaissance to the present. (Academic year)

Second Group

103 Oral French With Emphasis on Pronunciation (3) Huvé
The sounds of French; elements of phonetics. Exercises in reading and conversation with attention to accent, rhythm, and intonation. Prerequisite: Fren 10. (Fall)

108 Advanced French Grammar (3) Thibault
Compositions, drills, dictations. Translations into French. Prerequisite: Fren 10. (Spring)

109 Advanced French Conversation (3) Huvé and Staff
Readings and discussions based on French culture and civilization. Oral and written reports. Prerequisite: Fren 10. (Fall)

110 Advanced Written French (3) Huvé and Staff
Study of vocabulary and syntax with emphasis on stylistic devices. (Spring)

111 Advanced French Conversation: The Language of Government, Politics, and Economics (3) Huvé
Discussions and questions based on recent articles from the press. Emphasis on vocabulary, pronunciation, syntax, and translations. (Summer)

119 French Literature of the Middle Ages (3) Cruz-Sáenz
Literary history and development of ideas. Readings in the epic, courtly lyric, satire, and drama. Analysis of texts and discussion of criticism. (Fall)

120 French Literature of the Renaissance (3) Burks
Prose writers of the Renaissance from Rabelais to Montaigne; poetry and poetic theory in the Renaissance from the *Grands Rhétoriqueurs* to the *Pléiade*. (Spring)

121 17th-Century Classical Theater (3) Burks
(Spring)

122 17th-Century Prose and Poetry (3) Burks

123 The 18th-Century Novel and Theater (3) Ludlow
Study of the major French novelists and dramatists of the period. Emphasis on the works of Marivaux, Voltaire, Diderot, Rousseau, Laclos, and Beaumarchais. (Fall)

124 **The 18th-Century Enlightenment** (3) Ludlow
The contribution of Montesquieu, Voltaire, Diderot, and Rousseau to European and American thought of the period.

125 **Topics in 19th-Century French Literature** (3) Frey
(Spring)

126 **Topics in 19th-Century French Poetry** (3) Thibault

127 **20th-Century French Literature I** (3) Coffland
Fiction, poetry, and drama from 1900 to 1930. Chronological examination of authors and movements. (Fall)

128 **20th-Century French Literature II** (3) Coffland
Fiction, poetry, and drama from 1930 to the present. Chronological examination of authors and movements.

130 **Correspondences between Art and Literature** (3) Thibault
Expression of common preoccupations in diverse media. Readings, slides, lectures, and informal discussions. Topic to be announced in the *Schedule of Classes*. May be repeated for credit. (Summer)

133 **Seminar: French Literature** (3) Staff
Topic to be announced in the *Schedule of Classes*. May be repeated for credit. (Fall)

151 **Cinema and Literature** (3) Thibault
Interaction between film and literature; aesthetic theories and their applications to film and literary genres. Selected films and readings. May be repeated for credit. (Summer)

199–200 **Proseminar: Readings for the Major** (3–3) Burks and Staff
Required of all majors. Conferences and group discussions. (Academic year)

Third Group

202 **Thème et version** (3) Staff
Limited to graduate students; open to others only by permission of the instructor. Required of all graduate students in the field of French language and literature. Analysis and translation of selected prose passages, alternating between French and English; designed to teach students to write with precision and clarity.

213 **Medieval French Literature** (3) Cruz-Sáenz
Topic to be announced in the *Schedule of Classes*. Study of the origins and development of modern French from its Latin beginnings through Old and Middle periods. Some knowledge of Latin is desirable but not necessary. May be repeated for credit. (Spring)

214 **Seminar: Special Topics in Medieval French Literature** (3) Cruz-Sáenz
Topic to be announced in the *Schedule of Classes*. May be repeated for credit.

221 **Special Problems in 16th-Century French Literature** (3) Burks
Topic to be announced in the *Schedule of Classes*. May be repeated for credit.

229–30 **Literary Renaissance in Europe** (3–3) Burks
Study of the developments in the poetry of Italy, France, and England.

231–32 **Theater in the 17th Century** (3–3) Burks
Survey of the development of theatrical arts and the drama. Research papers and reports. (Academic year)

234 **17th-Century Nondramatic Literature** (3) Ludlow
Study of the poetry, novel, and philosophical writings of the Baroque and Classical periods.

241 **The Age of Enlightenment in Europe** (3) **Ludlow**
The contribution of the *philosophes* to the intellectual evolution of France and Europe. Emphasis on the relations among French, English, and German thought. Readings in English and French.

242 **Seminar: the French Novel and Theater in the 18th Century** (3) **Ludlow**
Major 18th-century French novelists and dramatists and a comparison of their work with that of some English and German writers of the period. Readings in English and French.

244 **Special Problems in 18th-Century French Literature** (3) Ludlow
Topic: Anglo-French literary relations, 1660-1800. May be repeated for credit. (Spring)

253 **Special Problems in 19th-Century French Literature** (3) Thibault
Topic to be announced in the *Schedule of Classes*. May be repeated for credit.

258 **Special Problems in 19th-Century French Poetry** (3) Frey
Topic to be announced in the *Schedule of Classes*. May be repeated for credit. (Fall)

264 **Seminar: Modern Period** (3) Thibault, Coffland
Topic: fall—studies in literary criticism; spring—narrative voices and new directions in the 20th-century novel. May be repeated for credit. (Fall and spring)

265 **20th-Century French Theater** (3) Coffland
Survey of the development of the theater from 1900 to the present. (Fall)

266 **20th-Century French Poetry** (3) Coffland
Background and development of poetry in the 20th century; *explication de texte* approach. (Fall)

295 **Independent Reading and Research in French Literature** (arr.) **Staff**
For students preparing for the Master of Arts degree. May be repeated for credit. (Fall and spring)

299–300 **Thesis Research** (3–3) **Staff**
(Fall and spring)

Fourth Group

George Washington University is a member of the Folger Institute of Renaissance and 18th-century Studies. Institute policies are set by a central committee on which each member institution is represented. Doctoral students enrolled in one of the Institute seminars are eligible to apply for fellowship aid. Folger Institute Seminars are numbered 301 through 308. Students wishing to register for these courses should consult the chairman of the Department of Romance Languages and Literatures.

301–8 **Folger Institute Seminars** (3 credits each) Staff
Topics will be announced in the *Schedule of Classes*. May be repeated for credit provided the topic differs.

398 **Advanced Reading and Research** (arr.) **Staff**
Limited to students preparing for the Doctor of Philosophy general examination. May be repeated for credit. (Fall and spring)

399 **Dissertation Research** (arr.) Staff
Limited to Doctor of Philosophy candidates. May be repeated for credit. (Fall and spring)

ITALIAN

First Group

1–2 First-year Italian (3–3) **Coffland and Staff**
A year course; credit toward a degree at this University given on completion of Ital 2. For beginners. Pronunciation, conversation, grammar, composition, readings. Oral practice in language laboratory. Laboratory fee, $17.50 per semester. (Academic year)

3–4 Second-year Italian (3–3) Coffland and Staff
A year course; credit toward a degree at this University given on completion of Ital 4. Conversation, grammar review, composition, reading of modern Italian prose, introduction to Italian civilization. Oral practice in language laboratory. Prerequisite: Ital 1–2. Laboratory fee, $17.50 per semester. (Academic year)

9–10 Italian Conversation and Composition (3–3) Coffland and Staff
Prerequisite: Ital 4 or equivalent and permission of instructor. (Academic year)

11 Italian through Opera (0) **Chambers**
Conversational Italian presented through excerpts from operas and their libretti. Pronunciation and grammatical principles, vocabulary and conversation. Tuition will be charged at the rate of one credit hour. (Summer)

Third Group

295 Independent Reading and Research in Italian Literature (arr.)
For students preparing for the Master of Arts or Doctor of Philosophy degree. May be repeated for credit. (Fall and spring)

PORTUGUESE

First Group

31–32 Intensive Portuguese (3–3) **Robb** (Academic year)
Prerequisite: knowledge of one other Romance language.

SPANISH

Departmental prerequisite: Span 3–4 or 6, or equivalent, is prerequisite to all courses in Spanish, from Span 9 and above, except for courses offered in English translation.

First Group

1–2 First-year Spanish (3–3) **Hicks and Staff**
A year course; credit toward a degree at this University given on completion of Span 2. For beginners. Pronunciation, conversation, grammar, composition, readings. Oral practice in language laboratory. Laboratory fee, $17.50 per semester. (Fall and spring)

3–4 Second-year Spanish (3–3) Hicks and Staff
A year course; credit toward a degree at this University given on completion of Span 4. Conversation, grammar review, composition, reading of modern Spanish prose. Oral practice in language laboratory. Prerequisite: Span 1–2. Laboratory fee, $17.50 per semester. (Fall and spring)

6 Second-year Spanish (6) Hicks and Staff
Lecture (3 hours), discussion (3 hours). Intensive course which covers material of Span 3–4. Prerequisite: grade of B or better in Span 2. Laboratory fee, $17.50. (Fall and spring)

9–10 **Spanish Conversation and Composition** (3–3) Hicks and Staff
Conversation, composition, vocabulary, and syntax. Prerequisite: Span 4 or equivalent. (Fall and spring)

12 **Spanish Conversation and Composition (Intensive)** (6) Hicks and Staff
Intensive, accelerated course which covers the material of Span 9–10. (Fall and spring)

20 **Prensa y Cultura: Intensive Spanish Conversation** (3) Azar and Staff
Intensive conversation organized around specific contemporary topics; illustrated by periodical material, films and interviews. (Summer)

49 **Spanish for Graduate Students** (0) Hicks and Staff
For graduate students preparing for reading examinations. No academic credit. Tuition is charged at the rate of three credit hours, plus University Center fee. (Fall and spring)

51–52 **Survey of Spanish Literature and Civilization** (3–3) Barnett
Social, artistic, and cultural background of Spanish literature. Lectures, readings, recitations, and informal discussions. (Academic year)

91–92 **Explicación de Textos** (3–3) Sáenz
Analytical introduction to Spanish and Spanish-American literature. Method demonstrated and practiced on selected passages. (Academic year)

Second Group

109–10 **Advanced Spanish Conversation and Composition** (3–3) Mazzeo and Staff
Development of writing and speaking skills. Emphasis on diction, grammar, and style. Prerequisite: Span 10 or equivalent. (Academic year)

119–20 **Medieval Spanish Literature** (3–3) Cruz-Sáenz
Survey by genre of the literature of the Middle Ages. (Academic year)

121–22 **Spanish Literature of the Golden Age** (3–3) Azar
Span 121: poetry and drama; Span 122: prose.

123–24 **Cervantes: Don Quijote** (3–3) Azar
The *Quijote* and the novel as a literary genre: reality and fiction. (Academic year)

125–26 **Modern Spanish Literature** (3–3) Mazzeo
Prose, poetry, and drama of the 18th and 19th centuries. Class analysis of texts, collateral readings, lectures on literature and history. (Academic year)

127–28 **Contemporary Spanish Literature** (3–3) Sáenz
Prose, poetry, and drama of the 20th century. Class analysis of texts, collateral readings, lectures on literature and history.

130 **The Modern Spanish Essay** (3) Mazzeo
Development of the Spanish essay from the 16th through the 20th centuries; emphasis on the 18th and 19th centuries. Class analysis of texts, collateral readings, and lectures. (Summer)

133 **Feminist Authors in Hispanic Literature** (3) Mazzeo
Development of feminist themes in Hispanic literature. Class analysis of representative works with readings in Spanish or in English translation. (Summer)

151–52 **The Spanish-American Novel** (3–3) Robb
Development of the novel in Spanish America. Lectures, collateral readings, and class analysis of texts.

155–56 **Spanish-American Literature to 1880** (3–3) Robb
Literature of Spanish America from the colonial period to the latter part of the 19th century. Lectures, collateral readings, reports, and class analysis of important works.

157–58 **Spanish-American Literature since 1880** (3–3) Robb
Literature of Spanish America from 1880 to the contemporary period. Lectures, collateral readings, reports, and class analysis of important works. (Academic year)

199–200 **Proseminar: Readings for the Major in Hispanic Language and Literatures** (3–3) Barnett
Required of all majors. Conferences and group discussions. (Academic year)

Third Group

215 **Seminar: Medieval Language and Literature** (3) Cruz-Sáenz
Topic to be announced in the *Schedule of Classes*. May be repeated for credit.

221 **Seminar: Cervantes' "Don Quijote"** (3) Azar
Cervantes' literary theories, the *Quijote* and its relations with the other *novelas cervantinas* as different modes of representing reality in literary fiction. (Fall)

224 **Seminar: "La Celestina"** (3) Azar
(Spring)

225 **Seminar: Special Problems in Golden-Age Literature** (3) Azar

231 **Seminar: 18th-Century Spanish Writers** (3) Mazzeo
Lectures and analysis of principal authors and works; relationships with subsequent literary movements.

242 **Seminar: Spanish Romanticism** (3) Mazzeo
Lectures and analysis of principal authors and works. Collateral readings. Problems of origins and development.

244 **Seminar: Naturalism and the Spanish Novel** (3) Mazzeo
Development of Naturalism in 19th-century Spain. Analysis of representative works of Pardo Bazán, Clarín, Blasco-Ibáñez and others. (Fall)

246 **Seminar: Works of Galdós** (3) Barnett
Ideological and stylistic analysis: relationship of Galdós' works to literary movements of the second half of the 19th century. (Spring)

248 **Seminar: Spanish Lyric Poetry of the 20th Century** (3) Sáenz
Stylistic analysis of the most significant poets from 1898 to the present. (Spring)

250 **Seminar: Novecentismo y Literatura de Entreguerras** (3) Sáenz
The prose writers: intellectualism and new forms of expression.

251 **Seminar: Works of Unamuno and Ortega y Gasset** (3) Sáenz
Study of the thought of Unamuno and Ortega y Gasset; analysis and commentary on the texts.

252 **Spanish Literature since the Civil War** (3) Sáenz
Development of the Spanish novel since 1939. (Fall)

253 **Seminar: Studies in Modern Spanish-American Poetry** (3) Robb
Poetic trends studied in selected poets and groups of poets from the Modernists through Post-modernists and Vanguardists to the present.

255 **Seminar: Studies in 20th-Century Spanish-American Theater** (3) Robb
Trends in modern theater with emphasis on Mexico, Central America, Puerto Rico, Chile, and the Río de la Plata area.

256 **Seminar: Studies in Mexican Narrative Prose** (3) Robb
Study of the emergence and development of the "New Mexican Narrative" through the works of Yáñez, Rulfo, Arreola, Fuentes, Leñero, and others.

261 **Seminar: Studies in the Spanish-American Short Story and Essay** (3) Robb
The Spanish-American short story and essay as artistic forms; selected modern short story writers and essayists. (Fall)

264 **Seminar: Studies in Recent Spanish-American Fiction** (3) Robb
The "New Spanish-American Narrative" studied in the novels and short stories of Borges, Bioy Casares, Cortázar, Vargas Llosa, García Marquez, Carpentier, Cabrera Infante, and others.

266 **Seminar: Alfonso Reyes: Essayist, Poet, Narrator** (3) Robb
Alfonso Reyes—essayist, poet, narrator and complete literary humanist—studied in his various prose and poetic works. (Spring)

287 **Seminar: Problems in Latin-American Civilization** (3) Staff
Same as Anth/Econ/Geog/Hist 287, and PSc 285.

295 **Independent Reading and Research in Spanish and Spanish-American Literature** (arr.) Staff
For students preparing for the Master of Arts degree. May be repeated for credit. (Fall and spring)

299–300 **Thesis Research** (3–3) Staff
(Fall and spring)

Fourth Group

398 **Advanced Reading and Research** (arr.) Staff
Limited to students preparing for the Doctor of Philosophy general examination. May be repeated for credit. (Fall and spring)

399 **Dissertation Research** (arr.) Staff
Limited to Doctor of Philosophy candidates. May be repeated for credit. (Fall and spring)

SANSKRIT

See **Germanic Languages and Literatures.**

SERBO-CROATIAN

See **Slavic Languages and Literatures.**

SERVICE-LEARNING PROGRAM*

Adjunct Associate Professor L.J. Lear
Assistant Professors H. Nashman, N.C. Garner, D.J. Lynn, G.J. Povar, P.M. Palmer
Instructor L.P. Love *(Coordinator)*

151 **Urban Legal Services** (6) Love
Field work combined with academic study of major concepts and issues underlying the urban legal system. Field placements (16-20

* Administered by the Division of Experimental Programs.

hours per week) in appropriate law-related organizations. Admission by permission of instructor. (Fall and spring)

152 **Issues in Education and Human Services** (6) Nashman
Exploration of the effects of education on society and vice versa; opportunities for experience, study, and service (16–20 hours per week) in public, private, museum, hospital, and community education centers. Admission by permission of instructor. (Fall and spring)

153 **Issues in American Health Care** (6) Povar and Lynn
Field work combined with academic study of present American health care system and its problems: cost, quality of care, delivery of health care, ethical issues, health education, consumer issues, etc. Field placements (16–20 hours per week) in appropriate health-related activities. Admission by permission of instructor. (Fall and spring)

154 **Independent Study** (3 or 6) Love
Field work combined with academic study, involving field-placements and complementary academic program of study, under the supervision of an appropriate faculty member. Students must "contract" with the agency, the faculty member, and the Service-Learning Program. Admission by permission of instructor. (Fall and spring)

155 **Issues in Managing the Arts** (6) Garner
Studies in the purpose and operation of the arts organizations in Washington. Weekly seminars and placement in an internship in an arts organization (16–20 hours per week). Discussion topics focus on the process of communication between artists and the public, the government, and the business community. Open to students with a demonstrated interest in the arts and the maturity to perform in a responsible position in an arts organization. (Spring)

158 **Society and Aging** (6) Lear
Exploration of the challenges posed by the rise in the median age of our population and the significant increase in the number of older Americans. Field work combined with academic study of the impact of these changes on political and economic institutions and on cultural values. Admission by permission of instructor. (Fall and spring)

159 **Women and Public Policy** (6) Palmer
Field work combined with academic study of policy issues affecting women. Field placements (16-20 hours per week) in local and national women's organizations which work to influence public policy. Admission by permission of instructor. (Fall and spring)

700 SERIES—
COURSES IN GENERAL AND INTERDISCIPLINARY STUDIES

Three sets of course numbers have been designated to identify new courses sponsored by this program in Columbian College, the School of Education and Human Development, the School of Government and Business Administration, the Graduate School of Arts and Sciences, and the National Law Center:

701 (General Studies)
721 (Interdisciplinary Studies)
770s (University Professors)

In each case, the course title is completed by a brief description of the topic of the individual course. 700 Series courses change frequently; interested students should consult the *Schedule of Classes* for the current semester. These courses are listed with the other offerings of participating departments; course descriptions appear in the section on the 700 series.

The 701 number designates courses taught by individual faculty members. They explore topics not normally included in departmental offerings, or utilize insights and methods from disciplines in addition to those usually identified with the sponsoring department. The 721 number designates upper-level courses in which faculty from two or more departments investigate a topic of mutual academic interest. Courses numbers in the 770s are taught by scholars who hold appointments as University Professors. The program is coordinated through the Division of Experimental Programs.

SINO-SOVIET STUDIES

See Institute for Sino-Soviet Studies.

SLAVIC LANGUAGES AND LITERATURES

Professors H.B. Yakobson, C.A. Moser *(Chairman)*, N.N. Natov, W.W. Rowe *(Research)*
Associate Professors G.A. Olkhovsky, I. Thompson
Assistant Professors M.F. Miller, R.M. Robin *(Visiting)*
Assistant Professorial Lecturer S. Ficks

Bachelor of Arts with a major in Russian language and literature (field-of-study or departmental)—The following requirements must be fulfilled.

1. The general requirements as stated on pages 71–72, 79–85.
2. Prerequisite courses—Slav 5–6 (preferred), or Slav 1–2, 3–4; or equivalent; and Slav 91–92.
3. Required for the major:

Field-of-study major—By the end of the senior year the student will be expected to have a good command of language skills and a grasp of the fundamentals of Russian structure, as well as a good foundation in Russian literature and culture. The passing of a major examination during the senior year is required. The department provides a proseminar to assist the student in preparation for the major examination.

Departmental major—from 30 to 36 semester hours of course work in the Department of Slavic Languages and Literatures distributed as follows: Language—12 to 15 hours chosen from Slav 9–10, 101, 103, 104, 109–10, 125: Culture and Civilization—six hours chosen from Slav 161–62, 172; Literature in Russian—six hours chosen from Slav 141, 142, 151, 152; Literature in English Translation—six to nine hours chosen from second-group courses.

A student who is already proficient in Russian language or literature may, upon passing an appropriate examination, waive any or all of the first-group language or literature courses, as well as up to six semester hours of second-group courses.

Bachelor of Arts with a major in Russian literature and culture—in translation (field-of-study)—The following requirements must be fulfilled.

1. The general requirements as stated on pages 71–72, 79–85.
2. Prerequisite courses—Slav 47 and 49, or Slav 1–2 and 3–4, or equivalent; and Slav 91–92.
3. By the end of the senior year the student will be expected to have a good grasp of Russian literature and the principles of literary criticism, as well as a general knowledge of Russian culture and history. The passing of a major examination during the senior year is required. The department provides a proseminar to assist the student in preparation for the major examination.

A student who is already proficient in Russian language or literature may, upon passing an appropriate examination, waive any or all of the first-group language or literature courses, as well as up to six semester hours of second-group courses.

Master of Arts in the field of Russian language and literature—Two areas of concentration are offered: Russian literature and Russian language.

Prerequisite: the degree of Bachelor of Arts with a major in Russian language and literature or Russian literature and culture—in translation from this University, or an equivalent degree. A student planning a concentration in Russian language must pass a Russian language entrance examination and must have a general knowledge of Russian literature and an acquaintance with Russian history and culture. A student planning a concentration in Russian literature must have a general knowledge of Russian literature, an acquaintance with Russian history and culture, and a general proficiency in the Russian language as demonstrated by the passing of a Russian language entrance examination.

Required: the general requirements, pages 89–96. All candidates must pass a reading knowledge examination in French, German, or a Slavic language other than Russian; a Russian language proficiency examination upon completion of 15 semester hours of course work; and a Master's Comprehensive Examination. Additional specific requirements are:

Concentration in Russian language: 24 semester hours of approved course work plus a thesis (equivalent to six semester hours) or 30 semester hours of approved course work without a thesis. The following courses are acceptable for the satisfaction of these requirements: Slav 152, 181, 186, 211, 212–13, 215, 218, 220, 225, 295; and Slav 101, 103, 104, with a translation project in consultation with a faculty member. .

Concentration in Russian literature: 24 semester hours of approved course work plus a thesis (equivalent to six semester hours) or 30 semester hours of approved course work without a thesis. Courses must include Slav 212–13 and at least 18 hours of literature.

Bachelor of Arts in Education and Human Development with a teaching field in Russian—Prerequisite: the education curriculum, pages 111–12.

Required: the Russian option and the professional courses listed on page 116.

Placement Examination: A student who has not been granted advanced standing and who wishes to continue in college the language begun in high school must take a placement examination before registration. Upon completion of the examination, assignment is made to the appropriate course.

First Group

1–2 First-year Russian (3–3) Yakobson, Miller

Beginners' course in fundamentals of grammar and pronunciation. Slav 1 is prerequisite to Slav 2. Laboratory fee, $17.50 per semester. (Fall and spring)

3–4 Second-year Russian (3–3) Yakobson, Miller

Intermediate course in Russian language. Prerequisite to Slav 3: Slav 1–2 or two years of high school Russian. Prerequisite to Slav 4: Slav 3. Laboratory fee, $17.50 per semester. (Academic year)

5–6 Intensive Beginning Russian (6–6) Thompson and Staff

Classroom (7 hours), laboratory (1 hour). Beginners' intensive course in the fundamentals of Russian. Prerequisite to Slav 6: Slav 2 or 5. Laboratory fee, $17.50 per semester. (Academic year) Miller

9–10 Intermediate Russian Conversation and Composition (3–3)

Listening comprehension; oral and written practice. Prerequisite: Slav 4 or 6, or permission of instructor. (Academic year) Staff

11–12 Individualized Beginning Russian (3–3) Staff

13–14 Individualized Intermediate Russian (3–3) Staff

31–32 Elementary Polish (3–3)

Beginners' course in the fundamentals of grammar and pronunciation.

Prerequisite to Slav 32: Slav 31 or equivalent. Laboratory fee, $17.50 per semester. Offered if enrollment is sufficient.

41–42 Elementary Serbo-Croatian (3–3) Staff
Beginners' course in the fundamentals of grammar and pronunciation. Prerequisite to Slav 42: Slav 41 or equivalent. Offered if enrollment is sufficient.

47 Beginning Russian for Reading (3) Staff
For undergraduate and graduate students with little or no Russian who wish to acquire a reading knowledge of the language. No academic credit for graduate students. (Summer)

49 Russian Reading (3) Staff
Primarily for graduate students preparing for reading examinations. No academic credit for graduate students. Prerequisite: Slav 47 or equivalent. (Summer)

51–52 Elementary Bulgarian (3–3) Moser
Beginners' course in fundamentals of grammar and pronunciation. Prerequisite to Slav 52: Slav 51 or equivalent. Laboratory fee, $17.50 per semester. Offered if enrollment is sufficient.

71 Soviet Civilization (3) Olkhovsky
Survey of the Soviet Union's past and present development. Lectures, discussion, visual aids—in English. (Fall)

91–92 Introduction to Russian Literature (3–3) Moser
Emergence and development of Russian literature and ideas during the 19th and early 20th centuries—in English. (Academic year)

Second Group

101 Readings in the Soviet Press (3) Ficks
Representative reading and translation of Soviet periodicals and current publications in social sciences. Prerequisite: Slav 4, 6, 49, or permission of instructor. (Fall)

103 Scientific Russian (3) Ficks
Representative readings in the major fields of Russian contemporary scientific literature. Prerequisite: Slav 4, 6, 49, or permission of instructor. (Spring, even years)

104 Business Russian (3) Ficks
Study of Russian business vocabulary and concepts of business in the Soviet context. Prerequisite: Slav 4, 6, 49, or permission of instructor. (Spring, odd years)

109–10 Advanced Russian Conversation and Composition (3–3) Yakobson
Developing proficiency in oral and written expression. Prerequisite: Slav 10 or equivalent. (Academic year)

125 Special Problems in Russian Grammar (3) Thompson
Study of selected areas of Russian grammar: emphasis on their practical use. Prerequisite: two years of Russian or permission of instructor. (Summer)

128 Dostoevsky: The Man and the Artist (3) Natov
Sources and development of Dostoevsky's philosophical, religious, and aesthetic ideas. His influence on Russian and Western literature. Lectures, discussions, and reports—in English. (Fall)

141 Readings in 19th-Century Russian Prose (3) Rowe
Reading of representative prose texts of the 19th century—in Russian. Prerequisite: Slav 4 or 6, or equivalent. (Fall, even years)

142 Readings in 19th-Century Russian Poetry (3) Rowe
Reading of representative lyric poetry of the 19th century—in Russian. Prerequisite: Slav 4 or 6, or equivalent. (Spring, odd years)

143–44 The Russian Novel (3–3) Moser
Study of representative novels of the 19th and 20th centuries—in English.

151 Readings in 20th-Century Prose and Poetry (3) Natov
Reading and discussion of representative prose and poetry of the 20th century—in Russian. Prerequisite: Slav 4 or 6, or equivalent. (Fall, odd years)

152 Russian Drama (3) Natov
Readings of the most representative plays of the 19th and 20th centuries. Reports and class discussion—in Russian. Prerequisite: Slav 4 or 6, or equivalent. (Spring, even years)

156 Leo Tolstoy: His Life and Works (3) Rowe
Evolution of Tolstoy's artistic and philosophical ideas. Tolstoy's impact on Russian literature and society. Lectures, reports, and classroom analysis of his major works—in English. (Spring)

161–62 Russian Culture (3–3) Olkhovsky
Survey of Russian cultural heritage from origins of ancient Russia to present—in English. Lectures, discussion, reports. (Academic year)

165 Modern Russian Literature from the Revolution to World War II (3) Natov
Basic themes, trends, and literary figures of the 1920s and 1930s. The impact of the revolution and civil war on writers and literature. Lectures, discussions, reports—in English. (Fall)

166 Modern Russian Literature from World War II to the Present (3) Natov
Literature in wartime and in postwar years. The "thaws," new generation of writers, and new trends in literature of the 1960s and 1970s. Lectures, discussions, reports—in English. (Spring)

172 Soviet Dissent (3) Olkhovsky
Examination of artistic and intellectual dissent since the death of Stalin; underground press, songs, plastic arts—in English. (Spring)

181 Russian-English Oral Translation (3) Olkhovsky
Training in the special skill of oral translation from Russian into English. Prerequisite: Slav 109-10, or equivalent.

186 The Russian Short Story (3) Natov
Development of the Russian short story since 1800. Lectures, reports, and class discussion—in Russian. Prerequisite: Slav 9-10 or equivalent. (Spring, odd years)

199–200 Proseminar: Readings for the Major (3–3) Staff
Conferences and group discussions. (Academic year)

Third Group

211 Russian Phonology (3) Thompson
Linguistic analysis of the phonology of standard contemporary Russian. An appropriate knowledge of Russian is required. (Fall)

212 Russian Syntax I (3) Thompson
Linguistic analysis of the syntax of simple sentences in standard contemporary Russian. Lectures, discussion, independent research—in Russian. (Fall)

213 Russian Syntax II (3) Thompson
Linguistic analysis of the syntax of compound sentences in standard contemporary Russian. Lectures, discussion, independent research—in Russian. (Spring)

214 **Methodology of Teaching Russian** (3) **Thompson**
Survey of modern methods, techniques, and materials for teaching Russian as a foreign language. Examination of textbooks, classroom observation, practice teaching. Prerequisite: 18 semester hours of Russian language. (Spring)

215 **Russian Historical Grammar** (3) **Moser**
An analysis of the historical development of Russian phonology, morphology, and syntax. An appropriate knowledge of Russian is required. (Fall, odd years)

218 **History of the Russian Literary Language** (3) Moser
The development of the norms of the Russian literary language from earliest times to the present. An appropriate knowledge of Russian is required. (Spring, even years)

220 **Russian Stylistics** (3) **Natov**
Analysis of various styles of contemporary Russian from the point of view of vocabulary and structure—in Russian. (Spring, odd years)

224 **Russian Literature to 1800** (3) Moser
Survey of Russian literature from the earliest times to the end of the 18th century. Appropriate knowledge of Russian required.

225 **Pushkin and the Poets of his Time** (3) Natov
Pushkin's predecessors; Pushkin's poetry and drama; Lermontov, the heir to Pushkin's poetic tradition—in Russian. (Fall, odd years)

253 **Seminar: Literary Criticism** (3) Natov
Study of leading Russian critics and their role in the development of Russian literature: the emergence of various literary schools—in Russian. (Spring, even years)

254 **Seminar: Literary and Intellectual Currents of the 1860s** (3) Moser
Discussion of literary and intellectual developments in the Russia of the 1860s. Reading knowledge of Russian required. (Spring, odd years)

255 **Seminar: Main Trends in 20th-Century Russian Literature** (3) Natov
Study of representative works since 1900; their artistic and social value—in Russian. (Fall, even years)

295 **Independent Reading and Research** (arr.) **Staff**
For students preparing for the Master of Arts degree. May be repeated for credit. (Fall and spring)

299–300 **Thesis Research** (3–3)
(Fall and spring)

SOCIOLOGY

Professors R.W. Stephens, I.H. Cisin, R.G. Brown, T.F. Courtless, Jr., P.H.M. Lengermann, R.A. Wallace, P.L. Stewart *(Chairman)*
Associate Professor J.L. Tropea
Assistant Professors T. Dietz, R.S. Frey

Bachelor of Arts with a major in sociology (departmental)—Three categories of majors are offered: (a) general major; (b) general major with a special concentration in crime, deviance, and justice; (c) general major with a special concentration in public policy. Options (b) and (c) require departmental approval. The following requirements must be met:

1. The general requirements as stated on pages 71–72, 79–85. (Students must consult the departmental advisor regarding courses to be taken in satisfying

the requirement for meaningful initiation into the humanities and the natural and mathematical sciences.)

2. Prerequisite course—Soc 1.

3. Required courses in related areas—12 semester hours in one of the following related social science fields: anthropology, economics, geography, history, political science, or psychology.

4. Required courses in the major—Soc 101, 140–41, 149; general majors: 15 additional semester hours in second-group sociology courses; concentration in crime, deviance, and justice: Soc 135, 136, 137, 139, and one additional second-group sociology course; concentration in public policy: Soc 120, 122, 128, 161, and one additional second-group course in sociology.

Bachelor of Arts with a major in criminal justice (departmental)—The following requirements must be fulfilled:

1. The general requirements as stated on pages 71–72, 79–85. (Students must consult the departmental advisor regarding courses to be taken in satisfying the requirement for meaningful initiation into the humanities and the natural and mathematical sciences.)

2. Prerequisite course—Soc 1.

3. Required courses in related areas—Anth 156, Phil 142, PSc 115, Psyc 130 and 154.

4. Required courses in the major—Soc 135, 136, 137, 139, 151 (9 credits), plus three additional second-group sociology courses.

Minor in sociology—A minimum of 15 hours of course work, including Soc 1, a basic course in either theory or methods, and nine hours of electives in courses at the 100 level or higher are required. There are two categories of minor: (a) a general minor; (b) a special concentration in one of the areas of concentration offered by the department, such as public policy or crime, deviance, and justice. Option (b) requires departmental approval. All students wishing to minor in sociology must seek departmental advising.

Master of Arts in the field of sociology—Prerequisite: a bachelor's degree with a major in sociology or in an approved related field.

Required: the general requirements, pages 89–96. With the approval of the advisor and of the Graduate Education Committee, students may elect one of the following programs: (1) at least 24 semester hours of graduate work plus a thesis (equivalent to six semester hours), satisfactory completion of a Master's Comprehensive Examination in sociological theory and social research methods, and an oral defense of the thesis proposal; or (2) at least 33 semester hours of graduate course work and satisfactory completion of a Master's Comprehensive Examination in sociological theory, social research methods, and one substantive special field (deviant behavior, political sociology, sociology of work, comparative social change, health policy, and social policy). Fifteen semester hours of elective courses must be interrelated in a logical way to form a subspecialization; 6 hours may be taken outside of the department.

In addition to the hours specified above, all candidates must satisfactorily complete Stat 105 or its equivalent. Students majoring in social policy need an additional statistics course; Stat 118 or 221 is suggested. All candidates must select from the graduate sociology courses as follows: six hours chosen from sociological theory (Soc 238 and 239 are recommended), six hours chosen from social research methods (Soc 230 and 231 are recommended), and six hours chosen from one special area (deviant behavior, political sociology, sociology of work, comparative social change, health policy, and social policy). Candidates must also fulfill the tool requirement by passing a reading knowledge examination in one foreign language, by satisfactorily completing the quantitative tool option, or by satisfactorily completing the graduate course work option.

Doctor of Philosophy in the field of sociology—Required: the general requirements, pages 89–91, 96–99. Students must complete from 30 to 36 semester hours of graduate course work, and from 12 to 18 semester hours of dissertation research, for a total of 48 hours beyond the master's degree. Students must include in their program of study Soc 332 and 6 semester hours of graduate course work in each of the following: sociological theory, social research methods, and two substantive specialties, at least one of which must be chosen from among those offered by the Department of Sociology—deviant behavior, political sociology, sociology of work, health policy, social policy, and comparative social change. Students must satisfactorily complete the General Examination in sociological theory, social research methods, and two substantive specialties. Students must also fulfill the tool requirement by taking any two of the following options: a reading knowledge examination in one foreign language, the quantitative tool option, or the graduate course work option.

Departmental prerequisite: Soc 1 is prerequisite to all sociology courses except Soc 181 and 191.

First Group

1 **Introductory Sociology** (3) **Staff**
General principles of sociology; development of culture and personality, impact of groups and institutions on man's social behavior. (Fall and spring)

2 **Major Social Issues** (3) **Staff**
Critical examination of selected social issues in contemporary American society. (Fall and spring)

Second Group

101 **Development of Social Thought** (3) **Lengermann, Stephens**
An exploration of the emergence and growth of sociology from 1800 to 1930, with emphasis on the elaboration of sociological concepts and theories. (Fall)

120 **Sociology and Public Policy** (3) **Dietz**
Introduction to concepts, theory, and research illustrating the application of the sociological perspective to public policy. (Fall)

122 **Cases in Policy Analysis** (3) **Dietz**
Sociological analysis of topical issues in public policy (e.g., education, health, energy, welfare). (Spring)

124 **Medical Sociology** (3) **Stewart, Brown**
Social factors and processes related to the etiology and treatment of physical and mental illness; medical occupations and professions, medical organizations, problems of delivery of health care services. (Fall)

125 **Sociology of Religion** (3) **Wallace, Yeide**
An analysis of the relationships between religion and society. Topics include the emergence of uniquely American religious forms such as civil religion and cultic groups. (Fall, odd years)

126 **Urban Sociology** (3) **Frey**
The sociological dynamics of the city and of urban growth in the United States; urban conflict, class conflict, and racism; problems of urban decay, crime and deviance, political competition, and revolt. (Fall)

127 **Population Problems** (3) **Stewart, Dietz**
Composition of populations, trends in population growth and popula-

tion pressure, factors producing population movements, effects of migration, population policies—eugenics and birth control. (Fall)

128 **Comparative Urban Sociology** (3) Frey
Processes of urbanization outside the United States; contrasts between socialist and non-socialist approaches to urban development urban communities in the Third World and their problems. Prerequisite: Soc 126 or permission of the instructor. (Spring)

129 **Race and Minority Groups** (3) Stephens
Analysis of relationships between dominant and minority groups in society, particularly in the United States; nature and range of problems; analysis of the phenomenon of prejudice. (Spring)

130 **Class, Status, and Power** (3) Stephens
Analysis of distribution of resources and opportunities for participation, education, and social mobility in American society; international comparisons; analysis of public policies which affect these distributions. (Fall)

132 **The Family in Modern Society** (3) Stephens
An examination of the stages of family life: birth, childhood, premarital relationships, marriage and sex roles in marriage, retirement and old age. Special emphasis on development and maintenance of interpersonal relations.

133 **Socialization and the Life Cycle** (3) Wallace, Tropea
Sociological approaches to the learning of cultural values and behavior from childhood through adolescence and adulthood. Emphasis on the relationship of socialization to selected groups, institutions social control, and change.

135 **Youth and Delinquency** (3) Courtless, Tropea
Analysis of historical, economic, and social conditions affecting both difficulties in socializing youth and the evolution of the state's formal systems of control. (Spring)

136 **Criminology** (3) Tropea, Courtless
Nature and distribution of crime as related to the development and operation of criminal law and various social and legal institutions in urban society. (Fall)

137 **Sociology of Law** (3) Courtless, Tropea
Law as a social phenomenon and agency of social control. Special emphasis is placed on study of the sources of and challenges to the legitimacy of law. (Fall)

139 **Deviance and Control** (3) Tropea, Courtless
Analysis of the development of primary deviance through processes of socialization; analysis of the creation of secondary deviance through collective definitions and responses, within varying historical, political, and social contexts. (Spring)

140–41 **Social Research Methods** (3–3) Cisin, Dietz
Soc 140: introduction to basic research methods in sociology. Soc 141: advanced research methods. Prerequisite to Soc 141: Soc 140 (Academic year)

143 **Social Movements** (3) Stephens
General survey of the various forms of collective behavior (fads, panics, riots, social movements, etc.), and a more detailed study of the genesis, development, and decay of social movements and social revolutions. (Spring)

149 **Modern Sociological Theory** (3) Wallace, Longermann
Systematic study of contemporary schools of sociological theory, both European and American; evaluation of scientific contributions of each school. Prerequisite: Soc 101. (Spring)

151 **Problems of Urban Social Systems** (9) Staff
Developing a comprehensive perspective on selected social problems through lectures and readings. Topic changes each semester. Prerequisite: 24 semester hours selected from economics, history, political science, psychology, and sociology. Admission by permission of instructor. (Fall and spring)

152 **Problems of Urban Social Systems—Supervised Field Work** (6) Staff
Accompanies Soc 151. A maximum of 24 hours a week will be spent in service-research efforts by placement in the Washington, D.C., area. (Fall and spring)

153 **Poverty in America** (3) Staff
Same as Econ 153

155 **Gender Roles and Socialization** (3) Wallace
The roles of women and men from social structural and social psychological perspectives. Analysis of gender roles in the work force, gender control in social structures, and how gender roles influence personal identity.

160 **Death and Dying: A Sociological Perspective** (3) Brown, Stewart
Processes of death and dying examined from cross-cultural and national perspectives. Topics include considerations of terminal care, abortion, murder, funeral customs, genocide, and the depiction of death in literature and philosophy. (Spring)

181 **Major Social Processes** (3) Staff
Analysis and examination of various processes in society of general importance to the field of sociology, e.g., social conflict, socialization, social change, etc. Topic changes each semester; may be repeated for credit. Admission by permission of instructor. A laboratory fee of $5 may be charged. (Fall and spring)

191 **Current Emphases in Sociology** (3) Staff
Analysis and evaluation of recent developments in the general field of sociology. Topic changes each semester; may be repeated for credit. Admission by permission of instructor. (Fall and spring)

195 **Research** (1, 2, or 3) Staff
Independent study and special projects. Open only to selected undergraduate students with promising academic records. Before students are permitted to register for Soc 195, they must submit a written proposal of their plan of study for the approval of the staff member of the department who will be directing their research. (Fall and spring)

Third Group

203 **Social Organization** (3) Wallace, Brown
Introduction to sociological concepts and perspectives. An examination of empirical studies which utilize different theoretical perspectives. Recommended for students offering sociology as a supporting field. (Fall)

204 **Overview of the Research Process** (3) Cisin
Recommended for students who lack undergraduate preparation or recent study in the methodology of social research, and for students offering sociology as a supporting field. Not open to graduate students in sociology except as a deficiency course. (Spring)

210 **Theoretical Foundations of Political Sociology** (3) Lengermann
Sociological theory on the relationship of politics to the wider social system. Emphasis on concepts of power, alienation, ideology, political stability, conflict, and change. (Fall)

220 **Seminar: Sociology of Religion** (3) Wallace, Yeide
Analysis of theoretical and empirical approaches to the study of religion as a social phenomenon. Both classical and contemporary contributions will be examined. Among the topics to be considered are secularization, new religious movements, and modes of religious organization. (Spring, even years)

225 **Theories of Social Change** (3) Lengermann
Review of sociological writings on modernity--its emergence in the North Atlantic societies, its consequences for third world societies, and its future. (Spring)

226 **Comparative Social Development** (3) Frey
Analysis of major issues in the sociology of development, urbanization, and modernization. Among the issues to be considered are political development, education, sex roles, urban growth, family welfare and change, and public administration. (Fall)

230 **Sociological Research Methods** (3) Cisin
Systematic survey of sociological research strategies and review of the literature in this area. Recommended for students with only one undergraduate course in research techniques. Prerequisite: Stat 105 or equivalent. (Fall)

231 **Seminar: Advanced Research Methods** (3) Cisin
Intensive study and evaluation of a few sophisticated research techniques and of new developments in the methodology of social research. Prerequisite: Soc 230, Stat 105, or equivalent. (Spring)

232 **Qualitative Methodology: Doing Field Research** (3) Stewart, Wallace
Practical application of data collection methods in natural settings: observation, participant observation, and field experience. Emphasis on implementing research projects using these methods for purposes of developing empirically grounded theory.

235 **Seminar: Sociology of Education** (3) Wallace, Tropea
Sociological theories on relationships between education and the economic, political, social, and cultural character of society; examination of social factors relating to such topics as educational achievement, the changing functions of educational structures, and the roles of teacher and student. (Spring, odd years)

238 **Seminar: Development of Sociological Theory** (3) Lengermann
Development of sociology from the early 1800s to the 1920s. Intensive analysis of the classical theoretical statements. (Fall)

239 **Seminar: Modern Sociological Theory** (3) Lengermann, Wallace
Intensive examination and evaluation of contemporary schools of sociological theory in Europe and America. Advanced analysis of theoretical perspectives. Prerequisite: Soc 238. (Spring)

240 **Sociology of Work and Occupations** (3) Stewart
Review of major theoretical and empirical developments in industrial sociology; varying approaches to the study of work and occupations. (Fall)

241 **Sociology of Work and Organizations** (3) Stewart
Theory of complex organizations relative to work in industry, government, and business; examination of basic processes such as decision-making, recruitment, allocation of authority, informal organization, and interorganizational relations. (Spring)

242 **Seminar: Medical Sociology** (3) Stewart
Sociological analysis of cultural, social, and social-psychological factors in occurrence and care of physical and mental illness as

they function in the community, the hospital, and in interpersonal relations; study of the social structure of health care services and interplay of the various health professions. (Spring)

252 **Seminar: Sociology and Social Policy** (3) Frey
Concepts, theory and research which demonstrate the applicability of a sociological perspective (for example, views on social systems, roles, formal organization, power, stratification, decision-making, social values) to the policy process. (Fall)

254 **Seminar: Methods in Social Policy Research** (3) Frey
Systematic survey of conceptualization, design, and practice of evaluation research of social experiments, and of simulation and technological forecasting. Prerequisite: Stat 105, Soc 230, 252; or permission of instructor. (Spring)

256 **Selected Topics in Social Policy Analysis** (3) Staff
A sociological perspective on selected policy areas, including urban planning, education, family, aging, health, affirmative action, law enforcement, and economic development. Particular policy areas will be rotated year by year. Course may be repeated for credit.

*259 **Law and Criminology I: Search for the Causes of Criminal Behavior** (3) Courtless, Tropea
Same as Law 475(2). (Fall)

*261 **Law and Criminology II: Society's Responses to the Criminal Offender** (3) Courtless, Tropea
Same as Law 476(2). (Spring)

263 **Seminar: Law and Society** (3) Courtless
Selected problems in law as an instrument of social policy; emphasis on the organization of legal decision-making processes. (Summer)

265 **Selected Topics in Criminal and Juvenile Justice Policy** (3) Courtless, Tropea
Development of a systematic perspective on policies affecting the juvenile and criminal justice systems. Topics will include adjudication, disposition, diversion, and sentencing. (Spring, even years)

280 **The Sociology of Aging** (3) Brown
Impact of current demographic changes (size and composition of the aged population) on the existing structure of American society. (Spring)

281 **Problems of Growing Old in American Society** (3) Brown
Analysis of the bases of the social status of the aged in American society, the impact on older people of characteristic situational changes in later life, and societal responses to those impact areas defined as social problems. (Fall)

290 **Principles of Demography** (3) Staff
Same as Econ 290.

291 **Methods of Demographic Analysis** (3) Staff
Same as Econ 291.

295 **Research** (arr.) Staff
Independent study and special projects. Before permission is granted to register for Soc 295, the student must submit a written plan of study for the approval of the staff member of the department who will be directing the research. May be repeated once for credit. (Fall and spring)

* Students registering for Soc 259 or 261 make special arrangements with the instructor for supplementary assignments equivalent to one additional semester hour. For description of the courses, see the *National Law Center Bulletin*.

299–300 **Thesis Research** (3–3) Staff
(Fall and spring)

Fourth Group

332 **Seminar: Processes of Inquiry** (3) Staff
Development and critical review of students' research projects with the objectives of aiding conceptualization and developing research design. Consideration of the interplay between theory and methods. Prerequisite: at least three semester hours each of graduate theory and graduate methods. May be repeated for credit.

351 **Selected Topics in Sociology** (3) Staff
Intensive investigation of special topics in sociology. May be repeated for credit. The following topics will be offered as the demand requires each fall semester: (1) *Social Research*—causal inference in social research, evaluation research, philosophy of science, etc.; (2) *Sociology of Work*—work and public bureaucracies, industrial sociology, etc.

352 **Selected Topics in Sociology** (3) Staff
Intensive investigation of special topics in sociology. May be repeated for credit. The following topics will be offered as the demand requires each spring semester: (1) *Sociological Theory*—study of important theorists such as Marx, Weber, Parsons; important themes such as social change, social control; important schools such as symbolic interactionism, general systems theory; (2) *Law and Society*—the sociology of law, theories of deviance, and related topics.

398 **Advanced Reading and Research** (arr.) Staff
Limited to students preparing for the Doctor of Philosophy general examination. May be repeated for credit. (Fall and spring)

399 **Dissertation Research** (arr.) Staff
Limited to Doctor of Philosophy candidates. May be repeated for credit. (Fall and spring)

SPANISH

See **Romance Languages and Literatures.**

SPECIAL EDUCATION

Professors R.S. Cottrell, Jr., R.K. Ives *(Chairman)*, J.R. Shotel
Associate Professors M.S. Castleberry, L.A. Tsantis, N.J. Sobel
Assistant Professors R.N. Ianacone, A.J. Mazur, A.E.C. Hunter, J.R. Snider, G.L. Harbin, M.B. Freund
Instructors M.T. Bailes, J.M. Helm *(Research)*

Programs of study in special education leading to the degrees of Bachelor of Arts in Education and Human Development, Master of Arts in Education and Human Development, and Doctor of Education are offered by the School of Education and Human Development (see pages 101–31).

Second Group Mazur

101 **Dimensions of the Complementary Teaching Role: Implementation of the Resource Room** (3)
Instructional experiences designed to refine the insights and competencies essential for successful operation of the complementary teaching model. (Fall)

102 **Practicum: Teaching the Child with Special Needs: Methods and Materials** (3) — Mazur
Laboratory course taught in an elementary public school. Students observe and participate in a demonstration seminar conducted by the instructor. Must be taken concurrently with SpEd 189. Material fee, $50. (Fall)

103 **Practicum: Teaching the Child with Special Needs: Creative Programming** (3) — Mazur
Continuation of SpEd 102. Concentration on the total programming of the child with special needs. Must be taken concurrently with SpEd 190. Material fee, $50. (Spring)

160 **Academic and Psychosocial Assessment of the Elementary-School-Aged Exceptional Child** (3) — Mazur
An investigation of the assessment process: theory and scope of psycho-educational assessment, informal and formal assessment, clinical experience in informal assessment, application of diagnostic findings to instructional recommendations.

168 **Overview of Handicapping Conditions: Etiology and Symptomatology** (3) — Bailes
Causes and symptoms of most prevalent handicapping conditions in the mainstreamable child.

170 **Dynamics of Human Relations: Theory and Practice** (3) — Mazur
Discussion of psychosocial theory as it relates to successful interaction with children. (Fall)

187–88 **Sign Language and Deafness** (3–3) — Donnels and Staff
Same as Educ 187–88.

189 **Preprofessional Internship: Program Adaptation for the Special Needs Child in the Regular Classroom** (3) — Bailes, Mazur
Supervised internship in school setting. Emphasis on intensive study of children with special needs. Must be taken concurrently with SpEd 102. (Fall)

190 **Preprofessional Practicum: Inspecting a Continuum of Special Education Services** (3) — Bailes
Observation and participation in various special education settings. Emphasis on exposure to and familiarity with goals and programs of various special education models. Must be taken concurrently with SpEd 103. (Spring)

197–98 **Special Study in Special Education** (3–3) — Staff
Individual or group study or research under the guidance of staff members. Program and conferences arranged with advisor. Admission by permission of advisor. (Academic year)

199 **Practicum in Complementary Teaching** (6) — Mazur
Supervised teaching internship in a school-based intervention program. Student teaching with children identified as needing special education services. A minimum of 240 clock hours required. Admission by permission of the instructor. (Spring)

200 **Psychosocial Development of Young Exceptional Children** (3) — Staff
The relationship between psychosocial development of the exceptional child and psychosocial development in general. Admission by permission of instructor. (Fall, alternate years)

Third Group

201 **Introduction to Special Education** (3) — Staff
Survey course to acquaint prospective teachers with special educa-

tion and to help them become aware of the various educational modifications necessary to accomodate children in a school program. (Fall)

220 **Selected Topics in Special Education** (3 or 6) Staff
Courses on topics relevant to special educators offered to selected groups.

221 **Accessing Community Systems for the Handicapped Child** (3) Freund
Overview of health, social, and educational services in the community. Provides an understanding of how best to integrate the handicapped child.

222 **Special Education in the Regular Secondary Classroom: Legislative Issues and Concerns** (3) Staff
Issues relating to interpreting and monitoring compliance with legislation addressing the needs of the handicapped in secondary schools. Emphasis on practical strategies in response to the mandates of current legislation.

229 **Vocational/Special Education Assessment for the Secondary-Level Handicapped Student I** (3) Ianacone, Hunter
Individual study of methods and materials used in academic assessment, including formal and informal testing to determine achievement, learning styles, process disorders, diagnostic information, behavioral readiness, and functional life skill attainment. Material fee, $20. (Fall)

230 **Vocational/Special Education Assessment of the Secondary-Level Handicapped Student II** (3) Ianacone, Hunter
Investigation of the vocational assessment process, including formal and informal systems to determine vocational interests, aptitudes, and employability skills. Material fee, $20. (Spring)

231 **Selected Vocational/Special Education Methods and Materials** (3) Staff
Selected materials and techniques used in teaching and programming for the secondary school level handicapped person in academic, career, leisure, and occupational skill areas. (Fall)

232 **Practicum: Vocational/Special Education** (3) Ianacone, Hunter
Practical experience at employment and training sites which offer programs in the areas of pre-vocational and vocational training. (Fall)

233 **Curriculum for Vocational/Special Education** (3) Staff
Examples and practice in designing, implementing, and modifying academic, career education, pre-vocational, and vocational curricula for the handicapped. (Fall)

234 **Seminar in Vocational/Special Education** (3) Staff
A weekly seminar which addresses the experiences, problems, and concerns encountered during the internship. Must be taken concurrently with SpEd 295. (Spring)

235 **Coordination of Job Placement Programs in Vocational/Special Education** (3) Staff
Programming options, rationale, and resources used to better serve persons with handicaps in the job placement process. (Spring)

236 **Secondary Career Planning for the Handicapped** (3) Staff
Introduction and analysis of current procedures and processes used in the career development and vocational preparation of persons with handicaps. (Summer)

260 **Developmental Assessment of Young Exceptional Children** (3) — Shotel, Tsantis
Lectures, demonstrations, and clinical practice in formal and informal assessment procedures. Admission by permission of instructor. (Fall)

261 **Practicum: Methods and Materials for Young Exceptional Children** (6) — Ives, Tsantis, Castleberry, Harbin, Shotel
Clinical practice in design and implementation of educational strategies and materials. Three dimensions: designing and developing teaching materials, classroom teaching, feedback and evaluation with professor. Taught at a demonstration site. Requires eight hours a week in service. (Fall)

262 **Seminar: the Education of Young Exceptional Children** (3) — Tsantis and Staff
Weekly seminar dealing with experiences, problems, and concerns encountered during the internship for the education of young exceptional children. Must be taken concurrently with SpEd 292. Admission by permission of instructor. (Spring)

263 **The Severely and Profoundly Handicapped Child: Development and Etiology** (3) — Staff
Survey of the characteristics and learning patterns of children with severe disabilities. Lecture and field experience. (Fall)

264 **The Severely and Profoundly Handicapped Child: Methods and Techniques** (3) — Staff
Specialized programs, techniques, and methods for teaching children with severe disabilities. (Spring, even years)

265 **Clinical Experience with Multiply Handicapped and Developmentally Disabled Young Children** (3) — Ives, Castleberry
Preliminary field experience designed for students with limited experience in early childhood special education. Supervised experience necessary for program articulation. Three-week intensive involvement in an early childhood special education setting. (Summer)

266 **The Development of Language in Young Exceptional Children** (3) — Staff
Introduction to the study of language acquisition and the application of current research on language of handicapped children. (Fall and Summer)

267 **The Early Childhood Special Educator: A Survey of Roles and Services** (3) — Tsantis, Freund
Examination of the spectrum of roles available in early childhood special education; emphasis on the historical, legal, and philosophical aspects of early childhood special education. (Summer)

268 **The Development of Young Exceptional Children with Emphasis on Handicapping Conditions** (3) — Freund and Staff
An in-depth examination of the development of young exceptional children and the specific nature of handicapping conditions. Lecture and field visitations. (Fall)

269 **Multidisciplinary Theory in Special Education** (3) — Castleberry and Staff
Seminar involving student presentations focusing on sociological and psychological constructs relevant to interpersonal/intrapersonal relationships. Material fee, $25. (Fall)

270 **Mainstreaming: Adapting Attitudes, Programs, and Curriculum to Meet the Needs of the Special Child** (3) Staff
Review of the basic curriculum areas as they relate to the development of readiness skills in special education. (Spring, alternate years)

271 **The Interdisciplinary Approach to Planning for the Exceptional Child: Theory and Practice** (3) Freund
Theory of, and field experience in, interdisciplinary team functioning. (Spring)

273 **Seminar for Special Education Strategist Intern** (3) Ives, Castleberry, Shotel
Weekly seminar dealing with experiences, problems, and concerns encountered during special education/early childhood strategist internship. Concurrent enrollment in SpEd 293 required. (Spring)

288 **Psychoeducational Characteristics of the Seriously Emotionally Disturbed Adolescent** (3) Sobel
An in-depth examination of relevant diagnostic categories, psychosocial development issues, and the nature and needs of the seriously disturbed adolescent. (Fall)

289 **Curriculum Methods for the Seriously Emotionally Disturbed Adolescent** (6) Sobel
Design and implementation of appropriate educational and management plans, under the supervision of the instructor in a field-based practicum experience. (Fall)

290 **Control and Management Techniques for the Young Exceptional Child** (3) Sobel
Examination of the theory, techniques, and tools essential for effective classroom management. Admission by permission of instructor. (Spring)

291 **Education of the Seriously Emotionally Disturbed Adolescent: An Integrative Seminar** (3) Sobel
Exploration of relationship between theory and practice, unifying total course work as it relates to professional interdisciplinary aspects. (Spring)

292 **Professional Internship in Education of Young Exceptional Children** (6 or 9) Tsantis, Freund, and Staff
Supervised internship in the education of young exceptional children. A minimum of 420 clock hours required. Must be taken concurrently with SpEd 262. (Spring and summer)

293 **Professional Internship for the Special Education/Early Childhood Strategist** (6 to 9) Ives, Castleberry, Freund, Shotel
Supervised internship in strategist role, emphasizing diversified, multi-dimensional aspects of a special education/early childhood program. A minimum of 420 clock hours is required. Concurrent enrollment in SpEd 273 required. (Spring)

294 **Professional Internship: Service to the Seriously Emotionally Disturbed Adolescent** (6) Sobel
Full-time placement as a psycho-educator in a residential or extended day-care site. (Spring)

295 **Professional Internship in Vocational/Special Education** (6 to 9) Ianacone, Hunter
Supervised internship in the vocational/special education of adolescent handicapped youth, emphasizing the diversified, multi-dimensional, and inter-agency cooperative needs for such programming. A

minimum of 420 clock hours is required. Must be taken concurrently with SpEd 234. (Spring)

296 **Philosophical, Legal, and Practical Issues in the Implementation of Public Law 94-142** (3) Shotel
Historical and legal perspectives that have led to Public Law 94–142, The Education for All Handicapped Children Act of 1975, and the consequences of this act on public school service delivery systems. Emphasis on the present and future impact of this law and its interpretation on the regular class teacher and administrator and on their roles within a public school system. (Summer)

297–98 **Individual Study in Special Education** (3–3) Staff
Individual study or research under guidance of staff member. Program and conferences arranged with advisor. Admission by permission of advisor. May be repeated for credit. (Academic year)

303 **Administration and Supervision of Special Education** (3) Staff
Philosophy and nature of special education; program organization, administration, and development. Surveying local needs; program evaluation and supervision. Admission by permission of instructor. (Spring)

304 **Recent Research and Trends in Special Education** (3) Cottrell
Emphasis on research methodology and considerations. The unique problems of doing research in special education. Procedures and sources for obtaining research funding. Admission by permission of instructor. (Fall)

306 **Dynamics of Family Intervention: Theory and Practice in Special Education** (3) Castleberry and Staff
Theoretical foundations and clinical techniques necessary for the early childhood special educator to successfully counsel parents of handicapped children. (Spring)

308 **Instructional Processes in Special Education: The Trainer of Trainers** (3) Ives
Review of the instructional processes as they affect education and special education, including the university and staff development perspective; opportunities for practice in needs assessment, program design and actual instruction. Admission by permission of instructor. (Fall)

343 **Psychoeducational Diagnosis of Children with Behavior or Learning Difficulties** (3) Tsantis and Staff
The range of diagnostic strategies applicable to the child who presents psycho-social and related learning difficulties. Admission by permission of the instructor. (Spring)

345 **Consultation Skills in Special Education** (3) Shotel
Consultation models from organizational development, organizational psychology, and mental health applied to in-service training for educational personnel and facilitating appropriate programs for the special child in the public schools. (Spring)

350 **Child Identification and Assessment: The Process of Planning Appropriate Educational Intervention** (3) Staff
Exposes administrators/supervisors to information relative to the exceptional child. Examines etiologies and symptomologies of handicapping conditions, developmental norms, identification and assessment strategies, and individualized educational programming.

351 **Seminar: Developing School/Community Support Systems—Models for Effective Service Delivery** (3) Staff
Provides experiences that facilitate effective service planning for the

handicapped child through the examination of existing models of family intervention, curriculum adjustment, and special education service delivery. Staff

352 **Seminar: Legal Issues and Public Policy Concerns in Planning Service Access for the Special Child** (3)
Reviews the responsibilities of their existing roles with regard to requirements generated by the legislative and judicial branches of the government. (Summer)

360 **Interdisciplinary Techniques in the Diagnostic Process in Special Education** (3) Tsantis and Staff
Application of theoretical concepts of assessment; development of assessment programs; interpretation and application of interdisciplinary diagnostic evaluations. Prerequisite: SpEd 260 or equivalent, and permission of instructor. (Fall)

370 **Attitude Change and the Access Process for the Special Child: Individual Ability to Change** (3) Ives
Applies specific psycho/social constructs germane to successful human interaction to the professional milieu of the special education consultant/administrator. (Fall)

Fourth Group

401 **Doctoral Mini-Seminar in Special Education** (3) Staff
Participation in a small group with a selected faculty member: intensive study and discussion of an area of common interest in an informal environment providing for the exchange of ideas and optimum potential for personal and professional growth. Admission by permission of instructor. (Spring)

453–54 **Doctoral Internship: Special Education** (6–6) Staff
Supervised professional internship in college teaching, administration, supervision, or private agency function. Each internship individually arranged. Admission by permission of advisor. (Academic year)

480 **Evaluation in Special Education** (3) Shotel
Application of educational evaluation models to special education situations. Special consideration given to the work of Haines, Popham, Scriven, Stake, Stufflebeam, Taba, and Tyler. Practical application of the theoretical models will be stressed. (Fall)

490 **Departmental Seminar in Special Education** (3) Shotel
Provides an opportunity for selected graduate students to develop, refine, and demonstrate their skills and abilities in a small-group setting with fellow students and department faculty. Admission by permission of instructor. (Fall)

491 **Dissertation Research** (arr.) Staff

Fifth Group Staff

701 **Experimental Course** (3)

721 **Experimental Course—Interdepartmental** (3)

SPEECH AND DRAMA

Professors J.W. Hillis (*Director of Speech-Language Pathology and Audiology*), L.S. Bowling (*Chairman*), W.M. Reynolds (*Director of Speech Communication*), L.S. Bielski, G.R. Herer

Associate Professors M.D.M. Brewer, J.R. Regnell, C.W. Linebaugh, J.E. Thiel

Assistant Professors N.C. Garner, S. Keller *(Director of Forensics)*, B.W. Sabelli, A.G. Wade, L.B. Jacobson *(Acting Director of Drama)*, W.A. Pucilowsky, B.R. Williams, C.E. Scala, S.L. Murray
Assistant Professorial Lecturers L.B. Beck, J.D. Schafer

Bachelor of Arts with a major in dramatic art (departmental)—The following requirements must be fulfilled:

1. The general requirements as stated on pages 71–72, 79–85. (Students should consult the departmental advisor regarding courses to be taken in satisfying the requirement for meaningful initiation into the social sciences and the natural and mathematical sciences.)
2. Prerequisite courses—SpDr 1, 11.
3. Required courses in related areas—24 semester hours of second-group courses outside the Department of Speech and Drama as approved by the major advisor (including 12 semester hours in dramatic literature).
4. Required courses in the major—SpDr 114, 151, 152, 153, 165–66; 18 additional semester hours in second-group drama courses.

*Bachelor of Arts with a major in radio-television (departmental)**—The following requirements must be fulfilled:

1. The general requirements, as stated on pages 71–72, 79–85. Students should consult the departmental advisor regarding courses to be taken in satisfying the requirements for meaningful initiation in the social sciences and the natural and mathematical sciences.)
2. Prerequisite courses—SpDr 1, 11, and 49 or 110.
3. Required courses in related areas—18 semester hours in a single subject area outside the Speech and Drama Department as approved by the major advisor.
4. Required courses in the major—SpDr 75, 133, 134, 137 or 138, and 1[illegible]. Twelve hours of second-group courses (three hours must be in a theory course) chosen from the areas of radio-television and film studies, and/or from speech communication, drama, and speech pathology/audiology as approved by the major advisor.

Bachelor of Arts with a major in speech communication (departmental)—The following requirements must be fulfilled:

1. The general requirements as stated on pages 71–72, 79–85. (Students should consult the departmental advisor regarding courses to be taken in satisfying the requirement for meaningful initiation into the social sciences and the natural and mathematical sciences.)
2. Prerequisite courses—SpDr 1, 11.
3. Required courses in related areas—12 semester hours in psychology and/or philosophy as approved by the major advisor; 18 semester hours in a single subject area outside the Department of Speech and Drama as approved by the major advisor.
4. Required courses in the major—SpDr 112, 121, 126; 15 additional semester hours of second-group courses in the Speech and Drama Department as approved by the major advisor.

Bachelor of Arts with a non-professional major in speech-language pathology and audiology (departmental)—The following requirements must be fulfilled:

1. The general requirements, as stated on pages 71–72, 79–85. Students should consult the departmental advisor regarding courses to be taken in satisfying the requirements for meaningful initiation in the social sciences and the natural and mathematical sciences.)

* Admission to this major may be on a selective or space-available basis.

attend a Folger Theatre Group production, and perform scenes from the plays. Prerequisite: permission of instructor. (Summer) Wade

110 **Interpretation** (3)
The study of literature through performance. Interpretation of prose, poetry, and drama. (Fall and spring) Reynolds

111 **Business and Professional Speaking** (3)
Study of the communication process in business and professional organizations; practice in interviewing, small group communication, and speeches for special occasions. Primarily for nonmajors. (Fall) Keller

112 **Persuasion** (3)
In-depth study of the principles and techniques of persuasion focusing on theory and practice. Emphasis is placed on the common-premise model while considering factors of image, support materials, emotion, audience analysis, and style. Prerequisite: SpDr 1 or permission of instructor. (Spring) Jacobson

113 **Voice for the Theater** (3)
The practice and application of voice production in four areas: skeletal alignment, breathing, resonance, and articulation. Emphasis is placed on individual awareness of the process of voice production and its application to dramatic texts. Prerequisite: SpDr 11 and permission of instructor. (Fall) Jacobson

114 **Introduction to Acting** (3)
Basic techniques of concentration, imagination, improvisation, and character analysis. (Fall and spring) Garner

115 **Scene Study: Classical Realism** (3)
(Formerly Acting I)
Principles of role development, concentrating on early 20th-century material by playwrights such as Chekhov, Ibsen, and Shaw. Concurrent registration in HKLS 115 required. Prerequisite: SpDr 114 and permission of instructor. (Fall) Garner

116 **Scene Study: Modern Comedy** (3)
(Formerly Acting II)
Principles of role development, comic timing, and stage business, concentrating on material by contemporary playwrights such as Slade and Simon. Concurrent registration in HKLS 116 required. Admission by audition. Prerequisite: SpDr 114 and permission of instructor. (Spring)

117 **Audition Techniques** (1)
The course examines all aspects of the audition process: selection and rehearsal of audition monologues, handling of cold reading, etc. Prerequisite: SpDr 114 or the equivalent. (Spring) Staff

118 **Structural Analysis of Speech and Language** (3)
Development of skills in the phonetic/phonemic transcription and syntactic analysis of oral language samples. Prerequisite: Psyc 115 or equivalent. (Spring) Hillis

119 **Clinical Procedures for Communication Disorders** (3)
Development of skill in precision treatment techniques for communication disorders. Emphasis on accountability of providers of clinical and educational services for the communicatively handicapped. Prerequisite: Psyc 121 and 131, or equivalent, and permission of instructor. (Fall) Hillis

120 **Advanced Study of Clinical Procedures for Communicative Disorders** (1 to 3)
Seminar on problems encountered in clinical practice for remediation of communicative disorders. Staffings of active case materials

from clinical and educational settings. Development of hardware and software programming skills for treatment of communicative disorders. Term project required for graduate students. Concurrent clinical or educational placement required. Prerequisite: SpDr 119 or equivalent. (Spring)

121 **Group Discussion and Conference Leadership** (3) Reynolds
Process of thinking and problem-solving in committees and small groups; methods of leading discussions and conferences. Prerequisite: SpDr 1 or permission of instructor. (Fall and spring)

122 **Scene Study: Verse Drama** (3) Garner
Principles of role development and handling of verse dialogue, concentrating on material by Shakespeare, as well as modern verse playwrights such as Maxwell Anderson, T. S. Eliot, and Christopher Fry. Prerequisite: SpDr 114 and permission of instructor. (Fall)

123 **Scene Study: Classical Comedy** (3) Garner
Principles of role development, concentrating on material from the English Restoration, Molière, and other 17th- and 18th-century playwrights. Prerequisite: SpDr 114 and permission of instructor. (Spring)

126 **Argumentation and Debate** (3) Reynolds
Study of the advocacy system; special emphasis on issue identification, use of evidence, and logical proof. Extensive practice in argumentative speaking. Prerequisite: SpDr 1 or permission of instructor. (Spring)

127–28 **Forensic Practice** (1–1) Keller and Wade
Student participation in intercollegiate speech activities. May be repeated for a total of four semester hours of credit. Admission by permission of instructor. (Fall and spring)

129 **TV News: The Politics of Visibility** (3) Lichter
Same as PSc 129.

132 **Radio-Television Performance** (3) Staff
Introduction to the basic theories and techniques required for effective, non-dramatic media performance (i.e., announcing, moderating, newscasting, etc.). Prerequisite: SpDr 1, 11, or 110. (Spring)

133 **Broadcasting in America** (3) Thiel
Study of the origins, structure, and nature of American broadcasting. (Fall)

134 **Radio Production** (3) Williams
Introduction to the basic concepts of radio as a communication medium; emphasis on the design and production technique of a variety of radio programs. Lecture (2½ hours), laboratory (2 hours). Prerequisite: SpDr 75 (for radio-television majors) or permission of instructor. Laboratory fee, $10. (Fall and spring)

135–38 **Radio Workshop** (1–1) Williams
Theory and practice in radio station operations. Admission by permission of instructor, after one semester of satisfactory participation in WRGW activities. May be repeated for a total of four semester hours of credit. (Academic year)

137 **Scriptwriting** (3) Thiel
Study and practice of the forms, techniques, and types of writing for radio, television, and film. Prerequisite: Engl 11 or 12, and SpDr 75 (for radio-television majors) or permission of instructor. (Spring, odd years)

138 **Scriptwriting: Selected Topics** (3) Wade
Intensive study and practice of a specific genre of radio, television, and film writing. Topics may include adapting the literary text, series

and serials, and anthology drama. Prerequisite: Engl 11 or 12, SpDr 75 (for radio-television majors) or permission of instructor. (Spring, even years)

141 Negotiations and Conflict Resolution (3) Keller
Communications factors involved in negotiation and conflict resolution. Use of models and simulations to explore prominent-solution approach to conflict situations. (Summer)

143 Origins of Contemporary Rhetorical Theory (3) Reynolds
Study of rhetorical theory and method as they evolved in the Western world from the classical period to the present. (Fall, even years)

144 History and Criticism of American Public Address (3) Reynolds
Study of American oratory from its pre-Revolution origins to the present day, interpreted in terms of issues and movements (Spring, odd years)

145 Introduction to Television Production (3) Thiel
Basic course in television production techniques and skills. Directing, script-writing, graphics, and other aspects of television production. Extensive practice in working television equipment; emphasis on various in-studio projects. Lecture (2 hours), laboratory (2½ hours). Prerequisite: SpDr 134. Laboratory fee, $10. (Fall)

146 Television Directing (3) Thiel
Advanced study and practice of television directing techniques. Students are expected to demonstrate skill in working with studio and electronic field production equipment and in the development of television programs from original concepts to final productions. Lecture (2 hours), laboratory (3 hours). Prerequisite: SpDr 145 and permission of instructor. Laboratory fee, $10. (Spring)

147 Innovations in Television Communication (3) Williams
Examination of current and future trends in electronic communications, with emphasis on both broadcast and non-broadcast radio and television, including technology, programming, industry structure, and public policy. Prerequisite: SpDr 133. (Fall)

148 Television Production (3) Williams
Close examination of the role of the producer in the television industry. Emphasis on the creative and executive aspects of producing. Prerequisite: SpDr 145. (Fall)

149 Communicative Effects of Broadcast Programming (3) Williams
Theories and research pertaining to issues, controversies, and problems of cultural conditioning in American broadcast programming. Prerequisite: SpDr 133 or permission of instructor. (Spring)

151 Stagecraft (3) Staff
Lecture (2 hours), laboratory (1 hour). Theories and practicum in construction, rigging, and scene painting. (Fall and spring)

152 Fundamentals of Stage Lighting (3) Staff
(Formerly Advanced Stagecraft)
Lecture (2 hours), laboratory (1 hour). Theories and practicum in the execution of lighting for the theater. (Fall and spring)

154 Directing (3) Garner
Fundamentals of script analysis, casting and rehearsal techniques. Prerequisite: permission of instructor. Laboratory fee, $10. (Fall) Staff

156 Make-Up Design (3)
(Formerly 1 credit)
Theory and practicum in the art of make-up design, including prosthesis, mask making, latex. (Fall)

157 **Stage Management** (1) **Sabelli**
Fundamental study of stage management with emphasis on practical production work, as well as theory. (Fall and spring)

158 **Theater Architecture** (1) **Sabelli**
Study of general principles, theories, and styles of theater architecture. (Spring, even years)

163 **Musical Theater** (3–6) Sabelli and Jacobson
Growth of American musical theater. Development of all its components: libretto, dance, composition, lyrics, and the overall fabric of production. (Summer)

165–66 **History of the Theater** (3–3) Jacobson
An examination of the development and growth of the theater from its beginnings to the present. SpDr 165: Greek through Restoration. SpDr 166: the 18th century to the present. (Academic year 1979-80 and alternate years)

171 **Language of Cinema** (3) **Staff**
Introduction to cinema as language through analysis of the components of film structure—camera, editing, sound, movement, music, dialogue and mise-en-scéne. Admission by permission of instructor for non-majors. (Fall)

172 **Film Directors and Styles** (3) **Staff**
Examination of influence on major film directors of twentieth-century art movements: German expressionism, Soviet constructivism, surrealism, neo-realism and structuralism. Comparison of film narrative with styles in dramatic and visual art forms. Prerequisite: SpDr 173 or 192. (Fall)

173 **History of Cinema** (3) **Staff**
An examination of motion picture history in terms of socially structured narrative from Griffith to Godard. Same as Art 173. (Fall)

174 **Special Studies in Film** (3) Staff
An intensive study of film structure as exemplified by the work of a single director or film genre. Prerequisite: SpDr 173 or 192. (Spring)

175 **The Political Image** (3) **Staff**
An analysis of the techniques of propaganda and rhetoric used in film and television to visualize political ideology. Admission by permission of instructor for non-majors. (Spring, even years)

176 **Film as Fact and Fiction** (3) Staff
A comparison of structural differences between documentary and fiction film in order to study how each presents different versions of reality. (Spring, odd years)

192 **The American Cinema** (3) **Staff**
History and criticism of American films. The course will enable the student to recognize and evaluate cinema techniques, to express the evaluation clearly in writing, and to understand the role of films in the context of American culture. Same as AmCv/Art 192. (Spring)

193 **Scene Design** (3) **Sabelli**
Fundamental study of scenography, including drafting, rendering, stage properties, and model construction. (Fall)

195 **Costume Design** (3) **Pucilowsky**
Fundamental study of costume design, including drawing and rendering techniques through specific projects. Laboratory work in costume construction. (Fall)

196 **Independent Study** (1 to 6) **Staff**
Independent research and special projects. Open only to under-

graduate students in their senior year. Before students are permitted to register for SpDr 196, they must submit a written proposal of the plan of study and obtain approval of the staff member who will be directing the study and of the department chairman.

Third Group

SpDr 268–290 and 295 are for Master of Arts candidates in the field of speech-language pathology and audiology; other students may be admitted by permission of the department.

213 **Special Problems in Speech for the Actor** (3) Jacobson
An advanced study of vocal production and interpretation for the actor. The work will focus on stage dialects, and the articulation and interpretation of Shakespeare's plays. Prerequisite: SpDr 113. (Spring)

215–16 **Acting: Scene Study** (3–3) Jacobson
Scene work in modern, classic, and other nonrealistic drama. Admission by audition. Both courses may be repeated once for credit. Recording fee, $4. (Academic year)

250 **Advanced Scene Design** (3) Sabelli
Preparation for the advanced student designer, with emphasis on the individual development of rendering techniques, technical drafting, traditional script analysis, and original scenographic interpretations. (Fall)

251 **Special Projects in Scene Design** (3) Sabelli
Exploration of all styles of traditional and contemporary scenography. Admission by permission of instructor. (Spring)

252 **Advanced Costuming** (3) Pucilowsky
Study of special design, style, and construction problems. (Spring)

253 **Problems in Costume Design** (3) Pucilowsky
The study of pattern drafting and draping methods based on historical costumes through lecture and classwork. Basic millinery construction and design. Prerequisite: SpDr 195. (Spring, even years)

255 **Lighting Design** (3) Sabelli
Theory and execution of lighting design for theater and television. Prerequisite: SpDr 152. (Spring)

256 **Directing Seminar** (3) Garner
Problems in directing plays from selected periods. May be repeated for credit. (Spring)

257 **Modern Trends** (3) Staff
Study of recent developments in dramatic theory, literature, and production. (Fall, even years)

258 **Theater Management** (3) Staff
Theory and practice in theater management: promotion, box office, and house management. Admission by permission of instructor. (Fall, odd years)

261–62 **Theatrical Styles** (3–3) Pucilowsky
Detailed study of the culture, climate, and production techniques of significant periods of drama. Prerequisite: SpDr 165–66. (Academic year)

267 **Interdisciplinary Study of Communication Disorders** (3–6) Staff
Individual study of philosophies and processes pertinent to communication disorders. Admission by permission of instructor. (Fall and spring)

268 **Clinical Practice in Communication Disorders** (1–3) Staff
Supervised clinical practice in the evaluation and treatment of com-

munication disorders. May be repeated for a total of three semester hours of credit. (Fall and spring)

269 **Community Programs in Communication Disorders** (3) Herer
Methods and procedure for the planning, management, and operation of hospital, school, and other community programs for the communicatively handicapped. (Spring)

270 **Audiological Evaluation of Children** (3) Bowling
A study of the development of the sense of hearing; underlying causes of auditory deficits and audiometric techniques used to measure hearing in children. (Summer)

271 **Developmental Disorders of Speech Production** (2) Regnell
Evaluation of persons with speech articulation disorders; test demonstrations, oral peripheral examination; special segments on evaluation and treatment of velopharyngeal dysfunction (including cleft palate) and cerebral palsy. Laboratory fee, $7.50 (Fall)

272 **Disorders of Speech Articulation** (3) Hillis
Consideration of speech articulation disorders from physiologic, acoustic, perceptual, linguistic, and learning points of view. Review of treatment methods and programs. Laboratory fee, $7.50 (Spring)

273 **Language Disabilities in Children: Identification and Diagnosis** (2) Staff
Review of current theoretical approaches to evaluation; a diagnostic model to facilitate evaluation and interpretation; review of available standardized tests; observation and testing experience. Laboratory fee, $7.50. (Fall)

274 **Language Disabilities in Children: Remediation** (3) Staff
Review of current therapeutic models; use of diagnostic information for designing a remedial plan; monitoring progress; coordinating language remediation with classroom and additional resource support; experience through monitoring ongoing language remediation. Laboratory fee, $7.50. (Summer)

275 **Speech Fluency Disorders: Evaluation and Treatment** (3) Hillis
Procedures for clinical assessment of stuttering and other disorders of speech rate and rhythm. Review of historical and current methods for treatment. Laboratory fee, $7.50. (Fall)

276 **Speech Fluency Disorders: Theory and Research** (3) Hillis
Consideration of stuttering and other disorders of speech rate and rhythm from developmental, linguistic, physiological, and psychosocial points of view. Laboratory fee, $7.50. (Summer)

277 **Differential Diagnosis of Acquired Language Disorders** (2) Linebaugh
Review of neurological substrates of language processing and widely used tests of acquired language disorders; consideration of patterns of communicative deficits related to various neuropathologies, with emphasis on their differentiating clinical features and prognosis. Laboratory fee, $7.50. (Fall)

278 **Rehabilitation of Acquired Language Disorders** (3) Linebaugh
Review of the nature of acquired language disorders and factors affecting patient performance; consideration of specific treatment approaches and methods for assessing recovery and efficacy of treatment. Laboratory fee, $7.50. (Spring)

279 **Motor Speech Disorders: Differential Diagnosis and Treatment** (3) Linebaugh
Methods of assessing motor speech disorders and their physical and

acoustic characteristics; approaches to the treatment of the dysarthrias and apraxia of speech. Laboratory fee, $7.50. (Summer)

280 **Functional Voice Disorders** (3) Regnell
Review of the normal structure and function of the vocal mechanism; acquisition of knowledge and of clinical-educational skills in providing speech evaluation and treatment for persons with functional voice disorders. Programs for the remediation of these voice problems will be covered. Laboratory fee, $7.50. (Fall)

281 **Organic Voice Disorders** (3) Regnell
Acquisition of knowledge and clinical/educational skills in providing speech evaluation and treatment for persons with organic voice disorders; special inclusion of management of laryngectomized persons. Laboratory fee, $7.50. (Spring)

283 **Aural Rehabilitation** (3) Brewer
Systems, principles, and methods of auditory training and speech reading, including development of lesson plans and their application in resolving communication problems of acoustically-handicapped individuals. Laboratory fee, $7.50. (Fall)

284 **Advanced Clinical Audiology** (3) Bowling
Principles and methods underlying assessment of auditory disorder; emphasis on bone conduction, masking, and speech intelligibility. Clinical implications, tests; demonstration and practicum. Laboratory fee, $7.50. (Fall)

285 **Hearing Aids** (3) Brewer
Discussion of hearing-aid characteristics and electroacoustic measurements; hearing-aid effectiveness in improving communicative efficiency; procedures for selection and clinical evaluation of hearing aids; counseling of the patient. Laboratory fee, $7.50. (Spring)

286 **Special Auditory Tests** (3) Bowling
Special speech and pure tone audiometric techniques for differentiating conductive, cochlear, and retro-cochlear lesions, for identifying functional hearing losses. Clinical application of tests and interpretation of results. Laboratory fee, $7.50. (Fall)

287 **Auditory Processing** (3) Bowling
Detailed study of the factors which affect auditory perception and comprehension; methods and procedures used in identifying disorders of auditory perception and comprehension. Laboratory fee, $7.50. (Spring)

288 **Psychosocial Aspects of Hearing Loss** (3) Bowling
Consideration of the rationale and procedures for evaluating the social and emotional behavior as well as the intellectual potential of those with impaired hearing. Laboratory fee, $7.50. (Spring)

289 **Impedance Audiometry and Middle Ear Function** (3) Staff
Development of skills in impedance audiometry and audiological assessment of middle ear function. Laboratory fee, $7.50. (Fall)

290 **Management of the Hearing-impaired Child** (3) Brewer
Overall management approach to the hard-of-hearing child including diagnosis, parent counseling, amplification, educational placement, treatment programs and procedures, and re-evaluation. Laboratory fee, $7.50. (Summer)

292 **Seminar: Communicative Disorders in School Children** (arr.) Staff
Variable topics concerned with provision of remedial services for hearing, language, and speech handicapped school children. May be repeated for credit. Admission by permission of instructor. Laboratory fee, $7.50. (Summer)

294 Independent Research in Dramatic Art (arr.) **Staff**
May be repeated for credit. (Fall and spring)

295 **Independent Research in Speech-Language and Hearing** (arr.) **Staff**

99–300 Thesis Research (3–3) **Staff**
(Fall and spring)

TATISTICS

rofessors H.F. Bright, S. Kullback *(Emeritus)* H.W. Lilliefors *(Chairman)*, A.D. Kirsch, J.L. Gastwirth, D. Krueger *(Research)*, S.W. Greenhouse, N.D. Singpurwalla, M. Halperin *(Research)*, R.T. Smythe, L.J. Wei
rofessorial Lecturers J. Bailar III, J. Kullback, K.M. Wolter
ssociate Professors R.E. Thomas, J.M. Lachin III *(Research)*
ssociate Professorial Lecturers P.P. Biemer, W. Rutiser, N.J. Kirkendall, R. Jacob, R. Abbott, T.C. Teeples
ssistant Professor P. Thall
ssistant Professorial Lecturers P. Wirtz, J.S. Wu

Bachelor of Arts or Bachelor of Science with a major in applied statistics (departmental), mathematical statistics (departmental), statistics with an option in computer science (departmental), or computer and information systems (departmental)—The following requirements must be fulfilled:

1. The general requirements as stated on pages 71–72, 79–85. (Students should onsult the departmental advisor regarding courses to be taken in satisfying he requirements for meaningful initiation into the humanities and social ciences.)

2. Prerequisite courses for all majors—Math 31, 32, 33; Stat 91 (except computer and information systems majors); Stat 97 or equivalent.

3. (a) Required courses for the applied statistics major—Math 124; Stat 106, 17, 118, 157–58, 189–90, plus three approved second-group courses in statistics. Courses in computer science and some field of application are recommended. oreign language is not required for this major.]

(b) Required courses in related areas for the mathematical statistics major -Math 124, 139, 140, 157; Stat 106, 117, 118, 157–58, 189, plus three approved econd-group courses in statistics; two years of introductory French, German r Russian, or equivalent. (Courses in computer science, mathematics, and some eld of application are recommended.)

(c) Required courses for the statistics major with an option in computer cience—Math 113, 124; Stat 97, 106, 114, 117, 118, 157–58, plus three approved econd-group courses in statistics. (Foreign language is not required for this major, but it is recommended for students planning to go to graduate school.)

(d) Required courses for the computer and information systems major—Math 113, 124; Stat 106, 114, 121, 133, 134, 142, 189–90, plus three approved courses from Stat 145, 166, 167, 178, 179. (Foreign language is not required for this major, but it is recommended for students planning to go to graduate school.)

To assure a balanced program, departmental approval of electives is required for all majors.

Students who seek Special Honors in statistics should check with the Department.

Minor in statistics—

1. General minor (with calculus): Stat 91, 117, 118, 157, 158, and 97 or 197.

2. Applied minor (without calculus): Stat 53 and 105, or 111 and 112, 118, 187 or 188, and 97 or 197.

3. Computer science minor (with calculus): Stat 97, 106, 114, 121, 133, plus one approved second-group course from those applicable to the computer and information systems major (see [d] above).

Master of Science in the field of applied statistics or *Master of Arts in the field of mathematical statistics*—The program of study consists of 30 semester hours of course work without a thesis. In exceptional cases the department may approve a program of study consisting of 24 semester hours of course work plus a thesis, equivalent to six additional semester hours. Candidates must pass a written Master's Comprehensive Examination and must fulfill the tool requirement by passing either a reading knowledge examination in an acceptable foreign language or an examination in computer language. For prerequisites and additional requirements, see below.

Master of Science in the field of applied statistics—Prerequisite: a bachelor's degree with a major in applied statistics from this University, or an equivalent degree. If undergraduate study did not include equivalent required courses, those courses must be taken as prerequisite to graduate study. Under certain circumstances some prerequisites may be waived; check with the Department.

Required: the general requirements, pages 89–96, including Stat 201–2. Courses are selected in consultation with the advisor.

Master of Arts in the field of mathematical statistics—Prerequisite: a bachelor's degree with a major in mathematical statistics from this University, or an equivalent degree. If undergraduate study did not include equivalent required courses, those courses must be taken as prerequisite to graduate study. Under certain circumstances some prerequisites may be waived; check with the Department.

Required: the general requirements, pages 89–96, including Stat 201–2 and 217–18. The remaining 18 semester hours must be selected in consultation with the advisor.

Doctor of Philosophy in the field of mathematical statistics—Prerequisite: the degree of Master of Arts in the field of mathematical statistics from this University, or an equivalent degree.

Required: the general requirements, pages 89–91, 96–99. A minimum of 24 semester hours of course work must be taken in residence at this University before the General Examination may be completed. The General Examination consists of two written parts, each followed by an oral examination. Part I covers mathematics and probability and may be taken after successful completion of Stat 259–60 or 273–74. Part II may be taken after the successful completion of the remaining core courses (Stat 201–2, 217–18, 257–58, 263–64, 265–66, 287) and electives selected in consultation with the advisor. The tool requirement may be fulfilled by passing a reading knowledge examination in one foreign language and an examination in computer language.

Research Fields: Biostatistics, design of experiments, information theory, multivariate analysis, nonparametric statistics, probability, robust methods, sampling, statistical inference, stochastic processes, and time series analysis.

Departmental prerequisite: One entrance unit in algebra is prerequisite to all first-group courses in statistics.

First Group

*51 **Introduction to Business and Economic Statistics** (3) Wei and Staff. Lecture (3 hours), laboratory (1 hour). Frequency distributions, de-

* Stat 51, 53, 91, 111, and 127 are related in their subject matter, and credit hours for only one of the five may be applied toward a degree.

scriptive measures, probability, probability distributors, sampling, estimation, tests of hypotheses, regression and correlation, index numbers. (Fall and sprng)

*53 **Introduction to Statistics in Social Science** (3) **Staff**
Lecture (3 hours), laboratory (1 hour). Frequency distributions, descriptive measures, probability, sampling, estimation, tests of hypotheses, regression and correlation. (Fall and spring)

*91 **Principles of Statistical Methods** (3) **Lilliefors**
Probability, frequency distributions and their characteristics, descriptive measures, estimation, tests of hypotheses, regression and correlation. (Fall and spring)

†97 **Introduction to Computing** (3) **Staff**
Computer and programming concepts; algorithm development. High-level language programs written by students will be run on the University computer. Laboratory fee, $25. (Fall and spring)

Second Group

103 **Sampling in Accounting** (3) **Bright**
Special emphasis on applications of sampling techniques to business decisions and to auditing; simple and stratified samples; cluster samples; opinion polling. Prerequisite: Stat 51, 53, 91, or equivalent. (Fall and spring)

105 **Statistics in the Behavioral Sciences** (3) **Kirsch**
Lecture (3 hours), laboratory (1 hour). Advanced study of statistical techniques for research problems. Analysis of variance, correlation techniques, nonparametric techniques, sampling theory. Prerequisite: Stat 53 or equivalent, and satisfactory performance on a placement examination. (Fall and spring)

106 **Computer Programming** (3) Thomas
Development of advanced computing ideas using a high-level language. Emphasis on careful design and implementation of programs using "structured programming." Prerequisite: Stat 97 or equivalent. Laboratory fee, $25. (Fall and spring)

*111 **Business and Economic Statistics I** (3) Thomas, Thall
Statistical methods appropriate for applications in economics and business. (Fall)

112 **Business and Economic Statistics II** (3) Thomas, Gastwirth
Continuation of Stat 111 with emphasis on techniques of regression, Chi-square, sampling designs, index numbers, and other topics used in economics and business. Prerequisite: Stat 111 or equivalent. (Spring)

114 **Data Structures** (3) Jacob
Files and file systems. Linked lists and trees. Basic structure of processing operations, creation, updating, sorting, merging, searching, linkage, hashing. Introduction to data processing, storage, and retrieval. Prerequisite: Stat 106. Laboratory fee, $25. (Fall)

117 **Analysis of Variance** (3) **Staff**
Lecture (3 hours), laboratory (1 hour). Introduction to the design of experiments and analysis of variance; random block, factorial, Latin square, and analysis of covariance. Prerequisite: Stat 118. Laboratory fee, $18. (Spring)

118 **Regression Analysis** (3) **Staff**
Lecture (3 hours), laboratory (1 hour). Regression and correlation

* Stat 51, 53, 91, 111, and 127 are related in their subject matter, and credit hours for only one of the five may be applied toward a degree.
† Credit will not be given for both Stat 97 and Stat 197.

theory; simple, partial, and multiple. Prerequisite: 3 semester hours selected from Stat 51, 53, 91. Laboratory fee, $18. (Fall and spring) Staff

121 **Survey of Programming Languages** (3)
Structured and non-structured languages; list-structured languages; pattern matching and symbol manipulation languages; interpretive and interactive languages; variable binding. Prerequisite: Stat 114. Laboratory fee, $25. (Spring) Staff

123 **Introduction to Econometrics** (3)
Same as Econ 123.

*127 **Statistics for the Biological Sciences** (3) Greenhouse, Lachin
Introduction to statistical techniques and reasoning applicable to the biomedical and related sciences. Properties of basic probability functions: binomial, Poisson, and normal. Data analysis, inference, and experimental design. (Fall and spring) Staff

131 **Contingency Table Techniques** (3)
Analysis of multidimensional contingency tables, including estimation, tests of hypotheses, and log-linear regression. Prerequisite: Stat 118 or permission of instructor. Laboratory fee, $25. (Spring) Staff

133 **Computer Organization and Assembly Language** (3)
Data representation and arithmetic; computer structure and machine language; computer architecture. Assembly language; addressing techniques; file input and output. Study of an actual small computer. Prerequisite: Stat 114. Laboratory fee, $25. (Fall) Staff

134 **Operating Systems** (3)
Techniques for handling simultaneous processes; dynamic procedure activation; synchronization and mutual exclusion; semaphores. Operating system design methodologies; abstract data types; monitors; kernels. Memory management; memory hierarchy; paging. Recovery procedures. Prerequisite: Stat 133. Laboratory fee, $25. (Spring) Staff

142 **Introduction to Automata Theory** (3)
Finite state automata. Turing machines and computability; universal Turing machine; computable and noncomputable functions; halting problem; computational complexity. Formal grammars and their relationship to automata. Prerequisite: Stat 114; a course in propositional calculus. Laboratory fee, $25. Staff

145 **Compiler Design** (3)
Grammars, languages, syntax, and semantics. Lexical analysis; symbol tables; context-free language parsing techniques; code generation. Prerequisite: Stat 142. Laboratory fee, $25. Staff

153–54 **Mathematical Models in Population Genetics** (3–3)
Basic elements of genetics and cell reproduction, deterministic models of gene frequency; the Hardy-Weinberg law; effects of mutation, migration, and selection on gene frequency; multiple loci and multiple allele models; inbreeding; Fisher's fundamental theorem of natural selection; stochastic models of changes in gene frequency, including methods of direct product branching processes and diffusion equation methods. Staff

155 **Introduction to Probability** (3)
Probability distribution, Bayes' theorem and postulate, mathematical expectation, laws of large numbers. Prerequisite: one entrance unit in algebra. Staff

157–58 **Introduction to Mathematical Statistics** (3–3)
Distribution theory, sampling theory, estimation, hypothesis testing

*Stat 51, 53, 91, 111, and 127 are related in their subject matter, and credit hours for only one of the five may be applied toward a degree.

regression analysis, experimental design. Prerequisite: differential and integral calculus. (Academic year)

159 **Principles of Bayesian Statistics** (3) Staff
Lecture (3 hours), laboratory (1 hour). Probability as a measure of uncertainty of knowledge; concepts and techniques of Bayesian inference. Prerequisite: three semester hours in introductory statistics, or equivalent.

160 **Mathematical Statistics for Economics Students** (3) Staff
Preparation for Stat 275. Prerequisite: differential and integral calculus. (Spring)

166 **Design and Development of Software** (3) Staff
Design techniques; structured programming; code reading; stepwise refinement; top-down design; information hiding; coupling and cohesion. Development of a multi-component software project by students. Prerequisite: Stat 114. Laboratory fee, $25. (Fall)

167 **Artificial Intelligence** (3) Staff
Representation of knowledge; notational systems such as logics, programming languages, trees, and networks; LISP. Search strategies; heuristics; production rule systems. Algorithms used in AI; natural language processing, vision, manipulator operation, theorem proving, problem solving. Prerequisite: Stat 114. Laboratory fee, $25.

178 **Data Base Systems** (3) Staff
Sequential file processing; random access storage. Hierarchical, network, and relational data models. Data normalization; data description languages; query facilities. File and index organization; inverted files. Data integrity and reliability; computer security. Prerequisite: Stat 114. Laboratory fee, $25.

179 **Simulation and Modeling** (3) Staff
Discrete simulation of real-world systems. Simulation techniques and languages; queues; event-driven simulation systems. Analysis of algorithms; predicting system performance; queuing theory. Prerequisite: Stat 114; some statistics. Laboratory fee, $25.

181 **Applied Time Series Analysis** (3) Staff
Auto- and cross-correlation, spectral analysis, coherence, transfer relations, linear filters, seasonal adjustment, mean square regression, autoregressive moving average models, forecasting, Box-Jenkins methods, spectral analysis of variance, and signal detection and discrimination methods. Prerequisites: a first course in statistics, calculus. Laboratory fee, $30. (Fall)

183 **Intermediate Statistical Laboratory: Statistical Computing Packages** (3) Staff
Application of program packages (e.g., Biomed, SPSS, SAS) to the solution of multivariate statistical problems. Basic concepts in data file, preparation/manipulation, analytical technique, and interpretation of results. Prerequisite: 3 semester hours selected from Stat 51, 53, 91. Laboratory fee, $25.

187 **Theory of Sampling** (3) Staff
Problems of sampling and sample design. Prerequisite: Stat 91 or equivalent. (Fall)

188 **Nonparametric Statistical Inference** (3) Lilliefors
Statistical inference when the form of the underlying distribution is unspecified. Prerequisite: Stat 91 or equivalent. (Spring)

189–90 **Mathematical Probability and Applications** (3–3) Staff
Combinatorial analysis, conditional probability, stochastic independence, probability distributions, random variables, laws of large

numbers. Prerequisite: differential and integral calculus. (Academic year)

193 **Questionnaire Design** Staff
Principles and procedures for developing effective questionnaires for mail, telephone, and personal interview surveys. Prerequisite: Stat 16 or equivalent, or permission of instructor. (Spring)

195 **Reading and Research in Statistics** (arr.) Staff
May be repeated once for credit. (Fall and spring)

*197 **Digital Computer Programming with Applications** (3) Thomas
Lecture (2 hours), laboratory (2 hours). Use of digital computer in statistical and other computational work. Writing, debugging, and running programs on the digital computer in the University Computer Center. Prerequisite: Stat 118; or Math 32; or permission of instructor. Laboratory fee, $25. (Fall and spring)

198 **Current Topics in Computer Programming** (3) Rutiser
Concepts of programming, programming languages, operating systems, nonnumeric programming compiler techniques. Prerequisite: Stat 114 or permission of instructor. Laboratory fee, $25. May be repeated for credit. (Spring)

Third Group

201–2 **Mathematical Statistics** (3–3) Staff
Distribution theory, sampling theory, estimation, sufficient statistics, hypothesis testing, analysis of variance, multivariate normal distribution. Prerequisite: advanced calculus or permission of instructor. (Academic year)

205 **Data Analysis for Policy Decisions** (3) Staff
The framing of questions of importance in policy and the use of existing data bases to answer these questions. Laboratory fee, $20. Prerequisite: Stat 105 or equivalent. May be repeated once for credit.

206 **Multivariate Methods in the Behavioral Sciences** (3) Kirsch
(Formerly Factor Analysis)
Application of multivariate analysis to data of the social sciences. Techniques covered will include factor analysis, cluster analysis, discriminant analysis, and other topics. Prerequisite: Stat 105 or 116 and prior permission of the instructor. Not open to graduate students in statistics. Laboratory fee, $20. (Summer)

215–16 **Applied Multivariate Analysis** (3–3) Staff
(Formerly Stat 165–66, Multivariate Techniques)
Application of multivariate statistical techniques to multidimensional research data from the behavioral, social, biological, medical, and physical sciences. Prerequisite: Stat 117, 157–58, and Math 124. Laboratory fee, $18. (Academic year)

217–18 **Advanced ANOVA and Experimental Design** (3–3) Staff
Advanced theory and application of general linear hypothesis to experimental designs. Prerequisite: Stat 157–58 or 201–2; Math 124. (Academic year)

221 **Design of Experiments for Behavioral Sciences** (3) Kirsch
Applications of advanced experimental design to research problems in behavioral sciences and education. Prerequisite: Stat 105 or 118 or equivalent and permission of instructor. Not open to graduate students in statistics. (Spring)

223 **Bayesian Inference** (3) Staff
Systematic development of Bayesian viewpoint, with applications to the classical problems of statistics. Prerequisite: Stat 201–2.

* Credit will not be given for both Stat 97 and Stat 197.

225–26 **Introduction to Biostatistics** (3–3) Staff
Probability models, inference, and study design as applied to biomedical investigations. Prerequisite: Stat 201–2. (Alternate academic years)

231 **Contingency Table Analysis** (3) Staff
A study of the theoretical bases underlying the analysis of categorial data. Prerequisite: Stat 201–2 or 257–58.

242 **Advanced Statistical Problems in Economic Analysis** (3) Gastwirth
Applications of advanced theory to economic data.

257–58 **Distribution Theory** (3–3) Staff
Properties of distribution and characteristic functions, probability bounds, large- and small-sample theory, order statistics. Prerequisite: Stat 157–58 or 201–2. (Alternate academic years)

259–60 **Advanced Mathematical Probability** (3–3) Smythe
Measure theory, probability spaces, random variables, probability distributions, sequences and sums of random variables, conditioning, limit theorems, martingales. Prerequisite: Math 224 or equivalent. (Alternate academic years)

261 **Sequential Design and Analysis** (3) Staff
Wald's theory of sequential designs, optional stopping, choice of sequential experiments. Prerequisite: Stat 201–2. (Spring, odd years)

262 **Nonparametric Inference** (3) Staff
Inference when the form of the underlying distribution is unspecified.

263–64 **Topics in Statistical Inference** (3–3) Lilliefors
Estimation, testing of statistical hypotheses, tests of significance, likelihood ratio, Bayesian inference and the use of prior knowledge, decision theory. Prerequisite: Stat 201–2 or 257–58. (Alternate academic years)

265–66 **Multivariate Analysis** (3–3) Greenhouse
Tests of significance, homogeneity, independence, canonical and vector correlations, multivariate normal distribution, generalized Student's ratio, multivariate linear hypothesis, and analysis of variance. Prerequisite: Stat 201–2 or 257–58; Math 124. (Alternate academic years)

273–74 **Stochastic Processes** (3–3) Smythe
Fundamental notions of Markov chains and processes, generating functions, recurrence, limit theorems, random walks, Poisson processes, birth and death processes, applications. Prerequisite: Stat 189–90; and 201–2 or 257–58. (Alternate academic years)

275 **Econometrics I: Introduction** (3) Staff
Joint offering of the Departments of Statistics and Economics. Single-equation models of economic behavior. Statistical methods for testing economic hypotheses and estimating parameters. Introduction to simultaneous equations problems. Prerequisite: Stat 157–58 or equivalent, or permission of instructor. Recommended: a course in matrix theory. (Fall)

276 **Econometrics II: Simultaneous Equations Models** (3) Staff
Joint offering of the Departments of Statistics and Economics. Economic models and simultaneous equations systems. Prerequisite: Stat 275. (Spring)

279 **Methods in Economic Statistics** (3) Gastwirth
Joint offering of the Departments of Statistics and Economics. Statistical methods, such as regression, curve fitting, and index num-

bers used to summarize and analyze economic data. Prerequisite Stat 111 or equivalent. (Fall and spring) Staff

281 **Time Series Analysis I: Foundations** (3) Staff
Basic structure of stationary time series. Differentiation, integration, spectral representations, linear filtering, mean square estimation, the Finite Fourier Transform, laws of large numbers, autoregressive moving average processes. Prerequisite: Stat 201–2 and 259–60 or 273–74. (Spring)

282 **Time Series Analysis II: Statistical Inference** (3) Staff
Multivariate normal processes, spectral estimation, tests of hypotheses, regression, discrimination filtering, spectral analysis of variance. Prerequisite: Stat 281.

283 **Advanced Statistical Laboratory** (3) Staff
Application of the University computer to complex statistical problems on an individual study basis. Admission by permission of instructor. Laboratory fee, $25. May be repeated for credit only with permission of the Department. (Fall and spring)

285–86 **Seminar: Special Topics in Sample Survey** (3–3) Wolter
Admission by permission of instructor.

287–88 **Modern Theory of Sample Surveys** (3–3) Wolter
Application of statistical theory to the sampling of finite populations. Simple, stratified, cluster, double and subsampling. Special topics including super-populations and randomized response. Prerequisites: Stat 91 and Math 32 or equivalent. (Academic year) Staff

289 **Seminar** (3) Staff
Admission by permission of instructor. (Fall and spring)

290 **Principles of Demography** (3) Staff
Same as Econ 290.

291 **Methods of Demographic Analysis** (3) Staff
Same as Econ 291.

295 **Reading and Research** (3) Staff
May be repeated once for credit. (Fall or spring)

297 **Problems in Mathematical Statistics** (3) Staff

298 **Seminar: Special Topics** (3) Staff

299–300 **Thesis Research** (3–3)
(Fall and spring)

Fourth Group Staff

378 **Seminar: Topics in Econometrics** (3) Staff
Same as Econ 378.

398 **Advanced Reading and Research** (arr.)
Limited to students preparing for the Doctor of Philosophy general examination. May be repeated for credit. (Fall and spring) Staff

399 **Dissertation Research** (arr.)
Limited to Doctor of Philosophy candidates. May be repeated for credit. (Fall and spring)

UNIVERSITY COURSES

University Professors M. Cunliffe, A. Etzioni, P.J. Caws

University courses are offered by distinguished scholars and scientists who hold appointments as University Professors. With the approval of the department or program, appropriate University courses may be taken to satisfy degree program requirements. Permission of the University Professor is required. Specific courses are listed in the *Schedule of Classes*.

URBAN AND REGIONAL PLANNING

Professors D.C. McGrath, Jr. *(Chairman)*, S.S. Fuller
Associate Professor S. Greene
Associate Professorial Lecturers A. Kreimer, R.F. Kirby
Assistant Professors D.E. Gale, M.J. Enders
Visiting Lecturer O.T. Carr, Jr.

A program leading to the degree of Master of Urban and Regional Planning, which provides preparation for professional practice in the planning field, and areas of specialization in planning as components of programs leading to the degrees of Master of Public Administration, Doctor of Business Administration, and Doctor of Public Administration, are offered by the School of Government and Business Administration (see pages 131–62).

Second Group

153 **Principles of Urban Planning and Design** (3) Greene
Studio course for undergraduates. Basic elements of urban planning and design applied to community problems. Survey of planner's role in developing and implementing creative solutions to urban problems. (Fall)

154 **Survey of American Urban and Regional Planning** (3) Enders
Examination of the historical roots, recent trends, issues, and new directions of American planning concepts, as well as the social and political forces which shape the character of planning in the United States. The roles of institutions, politicians, planners, and the general public in the planning process. Particular emphasis is placed on urban planning at the local governmental level. Prerequisite: junior standing. Not open to graduate students of the Department of Urban and Regional Planning. (Summer)

Third Group

201 **Introduction to Urban and Regional Planning** (3) McGrath and Staff
Introduction to history, concepts, and activities of urban and regional planning. Discussion of trends in urbanism and the influences of technology and social change. (Fall and spring)

202 **Urban Planning Theory** (3) Gale
Development of the fundamental theories and concepts of urban growth and change, theories of the planning process, the role of politics in the planning process, and roles of the planner. Prerequisite: U&RP 201 or permission of instructor. (Fall and spring)

203 **Fundamentals of Urban Design** (4) Greene
Planning and design studio to develop and apply planning methods and graphic techniques, principles of land use and urban design; analysis of factors affecting community development and change. Open only to candidates for the degree of Master of Urban and Regional Planning. Laboratory fee, $20. Prerequisite: U&RP 201 or permission of instructor. (Spring)

207 **Land Development Planning** (3) McGrath
Selected problems in urban and regional planning: applications of zoning, urban renewal and special programs available for the implementation of development plans. Prerequisite: U&RP 201 or permission of instructor. (Fall)

208 **Urban Transportation Planning** (3) Kirby
Relationships between land use and the movement of goods and people in urban areas. Transportation planning principles, policy

problems, methods for analyzing demand and systems for urban travel; roles of public agencies and private interests in the planning and development of various modes. Prerequisite: U&RP 201. (Spring)

210 **Urban Development Economics** (3) Fuller
Economic forces affecting urban growth and change; relationships among cities, metropolitan areas, and regions in the context of the national economy; socioeconomic implications of urban land development policies; basic studies and methods of economic analysis. Prerequisite: Econ 217–18 or equivalent; U&RP 201. (Spring)

212 **Methods of Urban and Regional Analysis** (3) Fuller
Introduction to methods used to analyze, estimate, and forecast population, employment, income and economic growth and development. Includes time series, index numbers, survey sampling and questionnaire design, shift-share, and case study methods. Prerequisite: Stat 51 or equivalent. (Fall)

215 **Advanced Planning Problems** (4) McGrath and Staff
Investigation of complex problems of the metropolitan region, analysis of findings, formulation of proposals, and presentation of materials to faculty and cooperating groups. Multidisciplinary team and individual planning projects. Studio course. Laboratory fee, $20. Prerequisite: U&RP 203. (Fall)

218 **Metropolitan and Regional Planning** (3) Fuller
Multidisciplinary study of the methods of regional analysis and process of regional planning; development of projects of regional scale requiring problem analysis, synthesis, and plan formulation. Studio course. Laboratory fee, $20. Prerequisite: U&RP 203 and 212 or permission of instructor. (Spring)

232 **Urban Environment and the Planner** (3) Enders
Exploration of the relationship between people and their urban environment; emphasis on the role of the urban planner. Theory, research, planning methods, current issues, and laws examined. Prerequisite: U&RP 201 or permission of instructor. (Spring)

240 **Federal and State Urban Policy Development** (3) McGrath
Investigation of contemporary trends in the evolution of federal and state governmental functions and programs affecting urban growth and development policy. Planning functions in the evolving relationships among units of federal, state, and metropolitan agencies. Prerequisite: U&RP 201 or permission of instructor. (Spring)

251 **Housing and Community Development: Concepts and Methods** (3) Fuller
An examination of the basic theories, concepts, principles, and analytical methods for managing the planning process by which cities approach the resolution of their development and housing needs. Housing supply and demand conditions, market analysis, physical inventory methods, community facility planning and impact analysis, commercial revitalization, and neighborhood theory and dynamics. Prerequisite: U&RP 201 or permission of instructor. (Fall)

252 **Housing and Community Development: Case Studies and Applications** (3) Gale
The application of theory and methodology to contemporary housing and community development issues. Examination of federal policies and programs, community facilities, redevelopment and adaptive reuse projects, and the role of the private sector. Case studies and field trips. Prerequisite: U&RP 251 or permission of instructor. (Spring)

255 **Urban Housing** (3) **Fuller**
Examination of the building industry, housing market characteristics, analytical techniques, national needs, costs, financing, federal programs, technology, rehabilitation, and policy formulation. Prerequisite: U&RP 201. (Summer)

256 **Neighborhood Dynamics** (3) **Gale**
Residential location decisions as they affect land use in metropolitan areas. Middle class, elderly, and minority mobility patterns. Effects of discrimination, dislocation, condominiums, and historic preservation. Prerequisite: U&RP 201 or permission of instructor. (Summer)

257 **Fiscal Policy and Urban Planning** (3) Gale
Consideration of municipal fiscal conditions and their implications for urban planning. Examination of capital projects financing, tax policy and land use, and fiscal impact analysis of urban development. Prerequisite: U&RP 201 or permission of instructor. (Fall)

261 **Community Planning and Design: Concepts and Methods** (3) Greene
Investigation of perceptual, social, physical, and aesthetic factors in planning and design. Emphasis on interaction of users and the environment, principles and process of community design, visual analysis, evaluation and implementation techniques. Prerequisite: U&RP 203 or permission of instructor. (Fall)

262 **Community Planning and Design: Case Studies and Applications** (3) Greene
Planning and design studio; application of community design principles and process to typical problems of community change and development. Laboratory fee, $20. Prerequisite: U&RP 261 or permission of instructor. (Spring)

263 **Community Preservation and Design Studio** (3) Greene
Interdisciplinary studio class: application of the techniques and methods of historic preservation, urban planning, housing and community development, community design, and other disciplines to problems of revitalizing urban areas. Surveys, inventories, analyses, formulation of proposals, and presentation to faculty and cooperating groups. Laboratory fee, $20. Prerequisite: U&RP 201 or permission of instructor. (Summer)

276 **U. S. Architectural History** (3) Staff
Joint offering of the American Studies Program and the Urban and Regional Planning Department. Basic stylistic developments in American architecture from the 17th through the 20th centuries, with special emphasis on the applicability of style recognition to buildings and neighborhoods in urban America. Architecture as evidence of American cultural history and guide to historic preservation. (Fall)

277–78 **Historic Preservation** (3–3) Staff
Joint offering of the Urban and Regional Planning Department and the American Studies Program. The preservation movement and its literature. Review of current experience, preservation practice and techniques. Emerging aspects of historic preservation. Examples of historic, cultural and humanistic values affecting preservation activities. Same as Hist 277-78. (Academic year)

290 **Special Topics in Urban and Regional Planning** (3) **Staff**
Experimental offering: new course topics and teaching methods. May be repeated once for credit. (Fall or spring)

295 **Research Methods** (3) Staff
Directed research and investigation of special problems in community development. May be repeated once for credit. (Fall and spring) Staff

298 **Directed Readings and Research in Urban and Regional Planning** (3) Fuller

299 **Thesis Seminar** (3) Staff
Examination of thesis standards, research philosophy and methodology. (Fall and spring)

300 **Thesis Research** (3)
(Fall and spring)

Fourth Group
Fourth-group courses are primarily for doctoral students, and are offered as the demand requires. They are open to other graduate students at the discretion of the Department.

311–12 **Seminar: Public-Private Sector Institutions and Relationships** (3–3) Chitwood
An analysis and critique of alternative theoretical frameworks for describing, understanding, and predicting the nature, values, and actions of American public and private institutions. Problems, potentials, and alternatives for structuring public and private institutional arrangements to meet the needs of society. Staff

398 **Advanced Reading and Research** (arr.)
Limited to students preparing for the Doctor of Business Administration or Doctor of Public Administration general examination. May be repeated for credit. (Fall and spring) Staff

399 **Dissertation Research** (arr.)
Limited to Doctor of Business Administration or Doctor of Public Administration candidates. May be repeated for credit. (Fall and spring)

WOMEN'S STUDIES—GRADUATE PROGRAM

Assistant Professor P.M. Palmer *(Coordinator for Academic Affairs)*
Adjunct Assistant Professors E. Bloomfield, S. Leader

Committee on Women's Studies
V.R. Allan, E. Bloomfield, M.M. Cassidy, C.W. Conable, S.E. Haber, S. Leader, P.M. Palmer, S.J. Tolchin, R. Wallace

The Graduate School of Arts and Sciences offers an interdisciplinary program leading to the degree of Master of Arts in Special Studies with a concentration in Women's Studies, directed by the Committee on Women's Studies and drawing upon faculty from various departments within the university and resource persons in the community.

Women's studies seeks to examine and integrate the contributions of established academic disciplines to an understanding of the historical and contemporary role and status of women, and to provide training necessary to evaluate and formulate equitable public policy for women. Each student will work closely with an advisor in designing a program to meet individual research interests and professional goals. Prospective candidates should consult with the director of the Women's Studies Program.

Master of Arts in Special Studies with a concentration in Women's Studies—**Prerequisite: a bachelor's degree from an accredited college or university.** Students are expected to have completed the prerequisites to graduate courses.

Required: the general requirements, pages 89–96, and 36 semester hours of course work, with or without a thesis. At least 21 hours must be taken in arts and sciences departments. WStu 220, 225, 240, and 241 are required for all students; WStu 283 and 295 are required for students who do not elect a thesis; WStu 299 300 is required for those who elect a thesis. Of the remaining six courses, it is required that four be concentrated in one other department such as Economics, Sociology, or Public Administration, and that one be a graduate-level methodology course. All candidates are required to pass a Master's Comprehensive Examination. There is no tool requirement.

220 **Perspectives on Women** (3) Palmer
Research and theory from the social sciences and humanities as they influence the concept of public policies on women at work, in families, and in education. (Fall)

221 **Research Issues in Women's Studies** (3) Staff
Socialization and the educational system, work and the economy, sexuality and the family, health and life cycle issues. Problem identification in these and other areas; introduction to current research. Prerequisite: WStu 220. (Fall)

225 **Feminist Theory** (3) Staff
Theoretical foundations of feminism in the U.S. Theories and proposals for change currently espoused. Although focus is primarily on feminism of contemporary white America, some third world and European thought will be considered. (Fall)

240 **Women and Public Policy** (3) Leader
Systematic analysis of public policy formation at the federal, state, and local levels as it relates to the status of women. Strategies for change and impact of the women's movement. Team and individual research projects on executive decision-making, legislation and its implementation, and political party structures. (Spring)

241 **Women and the Law** (3) Bloomfield
Legal status of women. Emphasis on marital status, employment, media, education, health services, crime, and the Constitution. (Fall and spring)

251 **Women, Literature, and the Arts** (3) Staff
Woman as subject and object. Examination of stereotypes, themes, language, patterns, and symbolism in works by and about women. Particular attention to the woman as artist and the development of feminist criticism. (Spring)

260 **Women in the American Work Force** (3) Palmer
Joint offering of the American Studies Program and the Women's Studies Program. Multidisciplinary analysis of women's role in the labor force and historical changes in that role. Societal view of women's work in the home and outside it; interrelationships of women in and out of the work force; women's contributions, traditionally and during national crises; class, race, and ethnic differences. (Spring)

270 **Seminar: Selected Topics** (3) Staff
Investigation of a current policy issue of particular concern to women, or consideration of women's status in a particular social system. (Fall and spring)

280 **Independent Study** (3) Staff
May be repeated for credit. Arrangements must be made with sponsoring faculty member prior to registration.

283 **Practicum in Women's Studies** (3) Palmer
Study of the changing status of women through supervised assign-

ment to public and private agencies engaged in education, counseling, political action, and research. Placement arrangements should begin the semester prior to registration for this course.

284 **Practicum** (arr.) Palmer Staff

295 **Independent Research in Women's Studies** (arr.) Staff
Individual library or field research. Program advisor's approval of written proposal required.

299–300 **Thesis Research** (3–3) Staff

YIDDISH

See **Classics.**

ZOOLOGY

See **Biological Sciences.**

FACULTY AND STAFF OF INSTRUCTION

Columbian College of Arts and Sciences

Graduate School of Arts and Sciences

School of Education and Human Development

School of Government and Business Administration

School of Public and International Affairs

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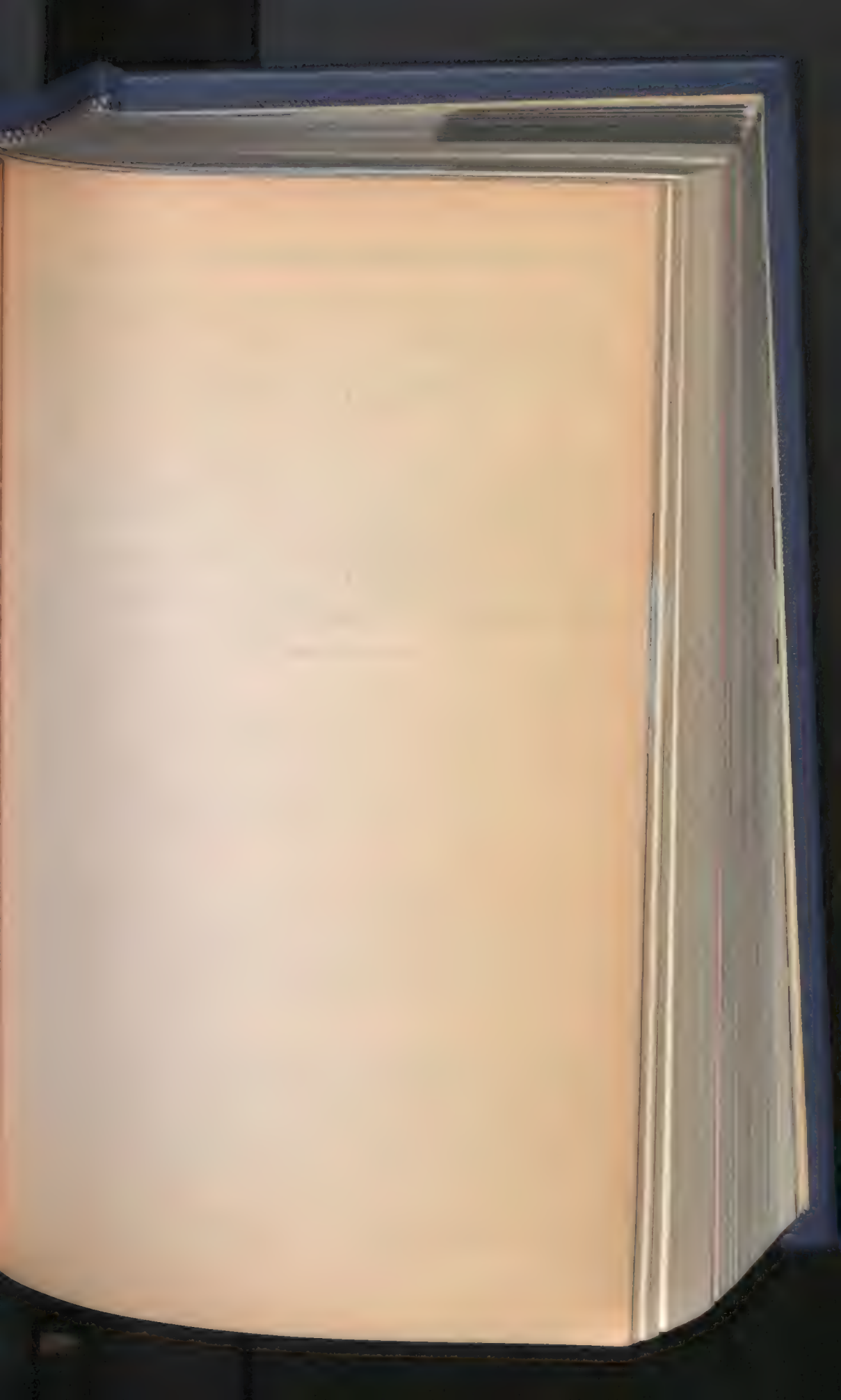
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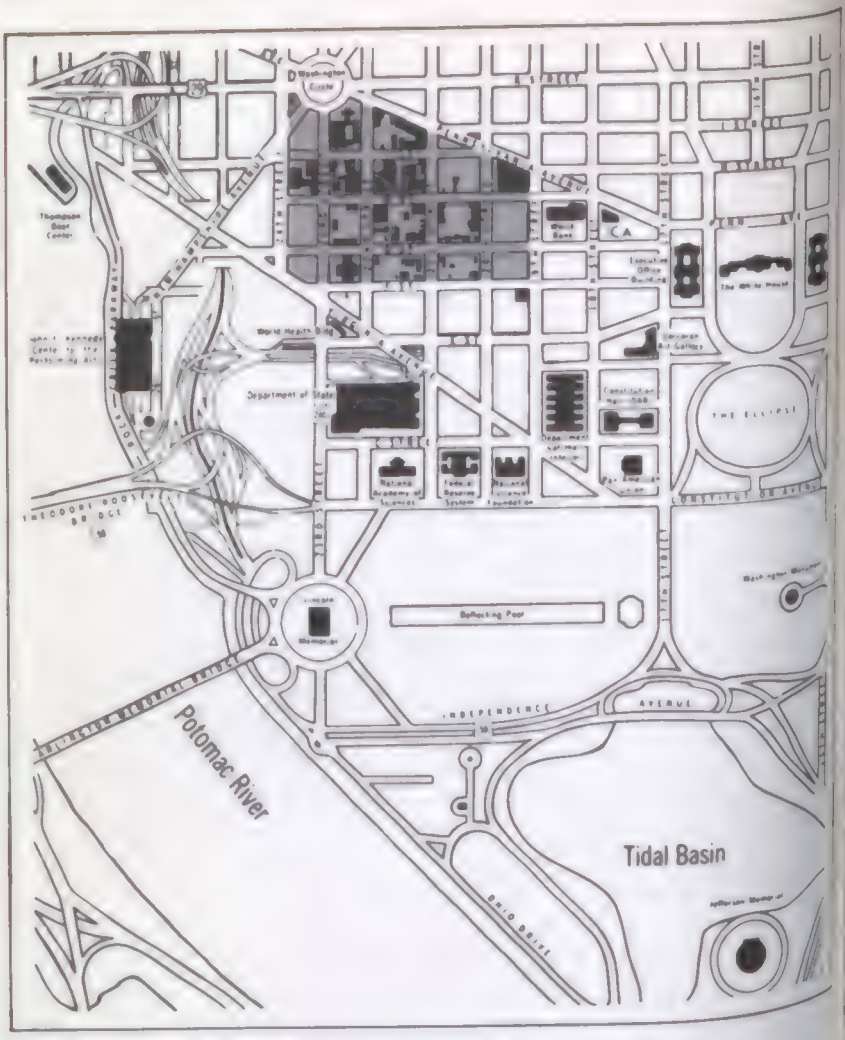

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July 5	Beginning of third-year clerkships, *Monday*
August 19–20	Orientation, *Thursday–Friday*
August 23	First day of classes for first-year students, *Monday*
August 30	First day of classes for second-year students, *Monday*
September 2	Registration for first- and second-year students, *Thursday*
September 6	Labor Day—holiday for first- and second-year students, *Monday*
November 24	Thanksgiving vacation begins after classes for first- and second-year students, *Wednesday*
November 29	Return from vacation, *Monday*
December 17	Winter vacation begins at 5:00 p.m. for first- and second-year students, *Friday*
January 3	Classes resume, *Monday*
January 13	Spring registration for all students, *Thursday*
February 21	Washington's Birthday—holiday for first- and second-year students, *Monday*
March 11	Spring break begins after classes for first- and second-year students, *Friday*
March 21	Return to classes, *Monday*
May 20	Last day of classes for first- and second-year students, *Friday*
May 23–27	Examination period for first- and second-year students, *Monday–Friday*
May 27	Commencement, *Friday*
June 26	End of third-year clerkships, *Sunday*

* This Calendar is subject to change. Although registration is conducted in both August and January, there is no precise date for the end of the fall semester; some courses end before the winter recess, while others begin before the January registration.

THE UNIVERSITY

HISTORY AND ORGANIZATION

The George Washington University had its beginning in 1821 as The Columbian College in the District of Columbia. The name of the institution was changed in 1873 to Columbian University and in 1904 to The George Washington University. The debt of the University to George Washington, whose name it bears, is an intangible one.

George Washington, as President and as private citizen, had urgently insisted upon the establishment of a national university in the federal city. There he hoped that, while being instructed in the arts and sciences, students from all parts of the country would acquire the habits of good citizenship, throwing off local prejudices and gaining at first hand a knowledge of the practice, as well as the theory, of republican government. To further the materialization of his hopes, Washington left a bequest of fifty shares of The Potomac Company "towards the endowment of a University to be established within the limits of the District of Columbia, under the auspices of the General Government, if that government should incline to extend a fostering hand towards it." The Congress never extended "a fostering hand." The Potomac Company passed out of existence, and Washington's bequest became worthless.

Fully conscious of Washington's hopes, but motivated primarily by a great missionary urge and the need for a learned clergy, a group of dedicated ministers and laymen sponsored a movement for the establishment of a college in the District of Columbia. Inspired largely by the zeal and energy of the Reverend Luther Rice, they raised funds for the purchase of a site and petitioned Congress for a charter. After much delay and amendment, Congress granted a charter which was approved by President Monroe on February 9, 1821. To safeguard the College's nonsectarian character it provided "That persons of every religious denomination shall be capable of being elected Trustees; nor shall any person, either as President, Professor, Tutor or pupil, be refused admittance into said College, or denied any of the privileges, immunities, or advantages thereof, for or on account of his sentiments in matters of religion."

During the entire time when the institution was known as Columbian College, its activities were centered on College Hill, a tract of forty-six and a half acres between the present Fourteenth and Fifteenth Streets extending north from Florida Avenue somewhat beyond Columbia Road. The Medical School was located downtown. For the better part of the Columbian University period,

the buildings of the University were situated along H Street between Thirteenth and Fifteenth Streets.

During the last half century the University's present plant has been developed in that section of the old First Ward familiarly known as "Foggy Bottom," between Nineteenth and Twenty-fourth Streets, south of Pennsylvania Avenue. Within a few blocks are the White House, the Department of the Interior, the State Department, the World Bank, and many other governmental offices and international agencies. The area has many reminders of historic interest to the University. President Monroe, who signed the Charter, lived at 2017 Eye Street. The first President of the Board of Trustees, the Reverend Obadiah B. Brown, was for 50 years the pastor of a church at Nineteenth and Eye Streets, and Washington selected Twenty-third and E Streets as the site of the National University he had hoped to see established.

The University as it is now organized consists of Columbian College of Arts and Sciences (undergraduate); the Graduate School of Arts and Sciences; the professional schools, which include the National Law Center and the schools of Medicine and Health Sciences, Engineering and Applied Science, Education and Human Development, Government and Business Administration, and Public and International Affairs; the College of General Studies; the Division of University and Summer Students; and the Division of Experimental Programs.

The George Washington University is privately endowed and is governed by a self-perpetuating Board of Trustees of which the president is an *ex officio* member.

ACADEMIC STATUS

The George Washington University is accredited by its regional accrediting agency, the Middle States Association of Colleges and Secondary Schools. The University is on the approved list of the American Association of University Women and is a member of the College Entrance Examination Board. The Department of Chemistry is on the approved list of the American Chemical Society.

The School of Medicine and Health Sciences has had continuous approval by the Council on Medical Education of the American Medical Association and the Association of American Medical Colleges. The Doctor of Medicine degree of the School of Medicine and Health Sciences is recognized by all state and territorial medical licensure boards in the United States.

UNIVERSITY POLICY ON EQUAL OPPORTUNITY

George Washington University does not discriminate against any person on the basis of race, color, religion, sex, national origin, age, handicap, or veteran status. This policy covers all programs, services, policies, and procedures of the University, including admission to educational programs and employment. The University is also subject to the District of Columbia Human Rights Law.

Inquiries concerning the application of this policy and federal laws and regulations concerning discrimination in education or employment programs and

activities may be addressed to Dr. Marianne Phelps, Assistant Provost for Affirmative Action, George Washington University, Rice Hall, Washington, D.C. 20052, or to the Assistant Secretary for Civil Rights of the Department of Education.

CLOYD HECK MARVIN CENTER

The Cloyd Heck Marvin Center serves as the campus community center, providing services, conveniences, and recreational and social opportunities for students, faculty, staff, alumni, and guests. Its wide range of facilities provides the setting for a variety of programs conducted by the University Program Board, the academic departments, and other student and faculty organizations.

The Center Governing Board, representative of all elements of the University community, plays an important role in the day-to-day functioning of the center. This board works closely with the full-time staff in the development of procedures and policies which provide a framework for the center's operation.

RECREATION

The nation's capital provides abundant recreational resources, a large number of which are available at little or no cost. There are numerous art galleries, museums, concert halls, theaters, swimming pools, parks, and places of great historic interest. Social activities are provided by student organizations of the University, the School of Medicine and Health Sciences, and University-sponsored programs such as intramural sports, concerts, recitals, and dramatic productions. Religious faiths are well-represented in the Washington metropolitan area. Washington is one of the most colorful cultural and scientific centers of the world.

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THE SCHOOL OF MEDICINE AND HEALTH SCIENCES

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Office of Academic Affairs

The Office of Academic Affairs bears the responsibility for the curriculum; student affairs, including scholarship and financial aid; research and sponsored programs, allied health programs; educational evaluation; admissions; and support services of the library and audio-visual and animal facilities.

Lawrence Thompson Bowles, M.D., Ph.D., *Dean for Academic Affairs*
Fred Leonard, Ph.D., *Associate Dean for Research*
Robert Keimowitz, M.S., M.D., *Associate Dean for Student Affairs and Admissions*
Winfield Harker Scott, Ph.D., *Associate Dean for Education and Director of Education*

Office of Administrative Affairs

The Office of Administrative Affairs is responsible for the administration of the University Hospital and the Medical Faculty Associates, for support services to the School of Medicine and Health Sciences, and for the financial management of the Medical Center.

Philip Stanley Birnbaum, M.S. in M.E., B.C.E., *Dean for Administrative Affairs*
Michael M. Barch, M.B.A., *Administrator of the Medical Center*
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Bruce Johnson Dietz, B.A., M.S., *Director of Management Information*

Office of Clinical Affairs

The Office of Clinical Affairs is responsible for the patient care activities of the University Hospital and the Medical Faculty Associates and for the supervision of the graduate and continuing medical education programs and community affiliation programs.

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HISTORY

The School of Medicine and Health Sciences of George Washington University has a distinguished history that goes back more than a century. In March, 1825, the School opened with the intention of building "a medical school commensurate with the progress and demands of a rising metropolis, and the improvement of service throughout the country." The School, the eleventh oldest medical school in the country, has met this responsibility by providing its students with a foundation in the medical sciences upon which they have built medical careers in practice, teaching, research, or administration.

In 1844 the School took on a new dimension when Congress granted it the use of the Washington Infirmary. Thus one of the earliest general teaching hospitals in the nation was established in Washington.

The distinguished history of the George Washington University School of Medicine and Health Sciences closely parallels academic advances and medical progress of the nation. The School has contributed to both.

The George Washington University Medical Center, established in 1966, consists of Walter G. Ross Hall, which houses the School of Medicine and Health Sciences; the Paul Himmelfarb Health Sciences Library; the University Hospital; the H.B. Burns Memorial Building, which houses the Medical Faculty Associates; the Helen L. and Mary E. Warwick Memorial Building; and affiliated hospitals.

In 1973, with the introduction of undergraduate programs in Allied Health Sciences, the name of the School was officially changed from the School of Medicine to the School of Medicine and Health Sciences.

Regulations

A student enrolled in the University is required to conform to the following regulations and to comply with the rules and regulations of the college, school, or division in which he or she is registered.

A student who withdraws or is suspended, or is otherwise absent from the University for one semester or more, may re-enter and continue scholastic work only under the regulations and requirements in force at the time of return.

If a student knowingly makes a false statement or conceals material information on an application for admission, registration card, or any other University document, the student's registration may be cancelled. If such falsification is discovered after the student has established an academic record at the University, the student may be subject to dismissal from the University. Such a student will be ineligible (except by special action of the Faculty) for subsequent registration in the University.

Academic Dishonesty

The University community, to fulfill its purposes, must establish and maintain guidelines of academic behavior. All members of the community are expected to exhibit honesty and competence in their academic work. Incoming students have a special responsibility to acquaint themselves with, and make use of, all proper procedures for doing research, writing papers, and taking examinations.

Members of the community will be presumed to be familiar with the proper academic procedures and are held responsible for applying them. Deliberate failure to act in accordance with such procedures will be considered academic dishonesty. Acts of academic dishonesty are a legal, moral, and intellectual offense against the community and will be prosecuted through the proper university channels.

Copies of the University policy on academic dishonesty can be obtained from the following offices: all department chairmen, all academic deans, and the Vice President for Academic Affairs.

University Policy on the Release of Student Information

The Family Educational Rights and Privacy Act of 1974 applies to institutional policies governing access to and release of student education records maintained by educational institutions which are recipients of Federal funds. The University complies with this statute, which states, in part, that such institutions must:

1. afford students access to education records directly related to them;
2. offer students an opportunity for a hearing to challenge such records as inaccurate, misleading, or otherwise inappropriate; and
3. receive the student's written consent before releasing information from his or her education records to persons outside the University, except for directory information as indicated below. Information may be furnished to a student's parents without such written consent only upon certification of the student's financial dependency; and

4. comply with a judicial order or lawfully issued subpoena to release a student's record, notifying the student of this action.

The University will release the following directory information upon request: name, local address, and telephone number; name and address of next of kin; dates of attendance; school, college, or division of enrollment; field of study; credit hours earned; degrees earned; honors received; participation in organizations and activities chartered or otherwise established by the University (including intercollegiate athletics); and height and weight of members of athletic teams. A student who does not wish such directory information released must file written notice to this effect in the Office of the Registrar.

Copies of the University's full policy statement on the release of student information may be obtained from the Office of the Registrar.

Right to Dismiss Students

The right is reserved by the University to dismiss or exclude any student from the University, or from any class or classes, whenever, in the interest of the student or the University, the University Administration deems it advisable.

Right to Change Rules

The University and its various colleges, schools, and divisions reserve the right to modify or change requirements, rules, and fees. Such regulations shall go into force whenever the proper authorities may determine.

Right to Make Changes in Programs

The right is reserved by the University to make changes in programs without notice whenever circumstances warrant such changes.

Student Conduct

All students upon enrolling and while attending The George Washington University are subject to the provisions of the *Statement of Student Rights and Responsibilities* which outlines student freedoms and responsibilities of conduct, the Judicial System for Non-Academic Student Discipline, and other policies and regulations as adopted and promulgated by appropriate University authorities. Copies of these documents may be obtained at the Office of the Vice President for Student Affairs. Sanctions for violation of these regulations may include permanent expulsion from the University which may make enrollment in another college or university difficult. Regulations or requirements applicable only to a particular program, facility, or class of students may not be published generally, but such regulations or requirements shall be published in a manner reasonably calculated to inform affected students.

University Policy on Drugs

The University cannot condone violations of law, including violation of those laws which proscribe possession, use, sale, or distribution of drugs. Members

of the academic community should know that administrative action, which may include dismissal from the residence halls, revocation of other privileges, or suspension or dismissal from the University, may be taken in order to protect the interests of the University and the rights of others.

The Libraries

Students have the privilege of using the University Library and the School of Medicine and Health Sciences Library. The stacks are open, and all students are welcome to browse at their leisure. A card denoting approved enrollment for the current semester must be presented when books are borrowed for outside use.

All students using the libraries are expected to be familiar with the regulations governing their use, which are available at each library.

Property Responsibility

The University is not responsible for the loss of personal property. A Lost and Found Office is maintained on campus in the Safety and Security Office.

Student Affairs

The Office of the Vice President for Student and Alumni Affairs develops student life programs, policies, and procedures to complement the University's formal instruction program. These activities are implemented through the offices of the Cloyd Heck Marvin Center, Counseling Center, Dean of Students, Educational Opportunity Program, Housing, International Services, Student Activities, Alumni, Student and Alumni Career Services, Student Health Service, and Services for Students with Disabilities. More detailed information on these and other activities is contained in the *Student Handbook*.

Student Health Service

The Student Health Service is an outpatient clinic located in the H.B. Burns Memorial Building at 935 22nd St., N.W.

The Health Service is staffed by physicians, nurse practitioners, and physician assistants who are capable of addressing most of students' medical problems. Visits are cost-free and may be either arranged by appointment or, during certain hours, secured on a walk-in basis. Most routine laboratory tests may be performed in the Health Service lab at cost, many common medications are stocked to fill students' prescriptions, and allergy shots and immunizations are administered by the staff nurse for a minimal charge. A psychiatrist works in the Health Service to assist students with mental health concerns.

For serious emergencies occurring during hours when the Student Health Service is closed, students may go to the Emergency Room of the University Hospital for treatment. This arrangement is for emergency care only, and all fees are the responsibility of the student.

Students must be currently enrolled on campus in the University to receive treatment at the Student Health Service. Students enrolled in the College of General Studies and Continuing Engineering Education Program are not eligi-

ble. Students who so desire may engage physicians and nurses of their own choice, but these students will be responsible for all fees charged. The bills incurred from all services rendered outside of the Student Health Service (for example, x-ray work, laboratory work, and referrals to specialists or other outside physicians) are the responsibility of the student.

Health and Accident Insurance

The University has arranged for and endorsed group health and accident insurance, on an elective basis, for those full-time students who do not have other coverage. Students are encouraged to carry adequate health insurance coverage for themselves and, if married, for their spouses and children. Interested students should contact the Student Health Service Office.

Residence Halls

Complete information concerning the University's residence halls is available from the Director of Housing, George Washington University, Washington, D.C. 20052. Information concerning off-campus housing may be obtained at this Office and at the Office of the Dean for Academic Affairs. Reservations for private housing must be made by students.

Guthridge Apartments

This apartment house is a University-owned, commercially operated building within the campus area. It contains efficiency and one-bedroom units which are rented only to full-time graduate students on an "as available" basis. Referrals to the resident manager of this building are made by the Director of Housing when notice is received of vacancies. Leases are executed with the management company and are on a month-to-month basis.

Housing for Undergraduate Allied Health Students

Admission to the University does not include a room reservation. The student will receive, with notification of acceptance, University residence hall information, an application for residence hall space, and a declaration of intent to attend the University. The application for residence hall space must be accompanied by a $200 *nonrefundable deposit*. The housing deposit is credited toward the first semester's room or apartment charge. Rooms are leased for the academic year, September to May, and lease payment must be made in June for the fall semester. Physician assistant and nurse practitioner applicants are not encouraged to apply for University housing in view of their extended academic year.

1982–83 RESIDENCE HALL RATES PER PERSON FOR TWO SEMESTERS*

For Men:

Calhoun Hall	
double room	$1,820
triple room	1,770

* Residence hall prices and allocation are subject to change.

For Women:

Strong Hall	
single room	$1,970
double room	1,820
triple room	1,770

For Men and Women:

Crawford Hall	
double room	1,820
Everglades Hall (limited to juniors and seniors)	
apartment for two persons	2,110 or 2,010
Francis Scott Key Hall (limited to juniors and seniors)	
apartment for two persons	2,010
apartment for three persons	2,010 or 1,890
Madison Hall	
double room	1,820
triple room	1,770
Milton Hall (limited to juniors and seniors)	
apartment for two persons	2,110 or 2,010
apartment for three persons	1,890
Mitchell Hall	
single room	1,970
Munson Hall (limited to juniors and seniors)	
apartment for two persons	2,110 or 2,010
apartment for three persons	1,890
Thurston Hall	
double room, triple room, room for four	1,820
suite for six	1,710

FOOD SERVICE*

Resident allied health students in the freshman and sophomore years are required to choose one of the following three food service plans: the seven-day, 19 meals per week plan, at the rate of $1,550* for the academic year; the any 14 meals per week plan for $1,480* for the academic year; or the any 10 meals per week plan at $1,420* for the academic year. Participation in the food service plan is optional for junior, senior, and graduate students, and for all students assigned to apartments. Food service payment does not cover University intersession or vacation periods. All meal cards admit the bearer to dining rooms in Thurston and Mitchell Halls and to the second-floor contract dining room in the Cloyd Heck Marvin Center. Meal cards may also be used on a cash equivalency basis in the Marvin Center first-floor cafeteria and Rathskeller.

Students who observe the Jewish dietary laws can write to make arrangements with the George Washington University Housing Office regarding the B'nai B'rith Hillel Foundation Kosher Meal Plan.

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* Food service prices are subject to change.

Veterans Benefits

The veterans counselor's office, on the third floor of Rice Hall, 2121 Eye St., N.W., assists students entitled to educational benefits as veterans, active duty personnel, or as widows or children of deceased or totally disabled veterans with any problems which may arise concerning their benefits. This Office also processes certification of enrollment and attendance to the Veterans Administration so that monthly allowances will be paid.

When feasible, students entitled to benefits as veterans or dependents of veterans should consult with the veterans counselor prior to submitting application to the Veterans Administration. All such students should obtain the instruction sheet issued by the Office of the Registrar, which sets forth requirements to be fulfilled before certification of enrollment can be made to the Veterans Administration, and which includes other information of general interest.

The Veterans Administration is at 941 N. Capitol St., Washington, D.C. 20421.

Facilities

Walter G. Ross Hall

Walter G. Ross Hall was dedicated and opened in 1973. This modern facility provides the teaching and laboratory facilities for students in the School of Medicine and Health Sciences. It occupies a city block on the northwest edge of the University campus; its gross area is approximately 550,000 square feet, or more than 10 acres. The building is equipped with modern audiovisual and other teaching equipment as well as basic science laboratories.

Educational Support Services

Educational Support Services is a group of core facilities and services supportive of the educational, clinical, and research missions of the Medical Center. Coordinated through the Associate Dean for Education, the services include the Office of Education, the Office of Audiovisual Education, the Office of Academic Computer Services, and the Paul Himmelfarb Health Sciences Library.

The Office of Audiovisual Education and Services, Frank Allan, Ph.D., Director—The goal of this office is the facilitation of learning and communication throughout the Medical Center by appropriate application of media technology. Consultation is provided in the use of nonprint media in educational, clinical, and research programs. The office provides displays of audiovisual materials and programs in classrooms, in the Audiovisual Study Center of the Himmelfarb Library, and throughout the Medical Center. It has highly developed production capabilities which are available to students and faculty. They include photographic, illustration, cinematographic, and television studios and a print shop which serve the Medical Center community. Virtually all learning spaces at the Medical Center are equipped for still and motion projection and television display. Those spaces subject to frequent use are equipped with permanent systems for projection, sound amplification, and recording designed to support staff and student presentations.

Office of Academic Computer Services, Helmuth F. Orthner, Ph.D., Director—This Office supports educational activities of the Medical Center with services such as educational testing, maintenance of test-item data banks, assistance in the design, construction, and duplication of written PMP examinations, student feedback evaluation, course registration, CME credit reporting, conference management support, and automation of library procedures and inventories. The Office also supports small research data bases for investigations requiring interactive data maintenance or for projects utilizing forms that can be optically scanned. Sophisticated statistical processing can be achieved by transmitting research data to the CAAC IBM mainframe with our on-line communications interface and processing the data with the appropriate statistical package. The Office also has facilities for word processing and a number of interactive psychodiagnostic questionnaires and histories for use by research investigators. It serves as an interface for computer-assisted educational material from the Massachusetts General Hospital and the Ohio State University.

The facilities of the Office consist of an on-line optical scanner (NCS 7001), a DEC PDP 11/60 minicomputer using the ANSI STANDARD MUMPS language environment, an on-line RJE 3780 communications link to the University Center for Academic and Administrative Computing (IBM 4341), a Gandalf communications facility to connect terminals from various locations of the School via dedicated lines using high-speed modems, and several dial-up ports for the switched telephone network.

Office of Education, Rhonda M. Goldberg, M.A., Director—The primary task of the Office of Education is to work with faculty and students to improve



the educational enterprise. The Office conducts evaluations of courses and curricula and works toward the establishment of effective systems for evaluating student performance. Consultation is provided to faculty in support of their teaching skills, to students in support of their efforts to learn, and to the Office of Academic Affairs in support of its administration of the educational program.

Paul Himmelfarb Health Sciences Library, Shelley Bader, M.L.S., Director—The Library's collection of more than 76,000 volumes and approximately 1,300 journal subscriptions serves the educational, research, and patient care needs of the Medical Center. These resources are further enhanced by audiovisual media housed in the Library's Bloedorn Audio Visual Study Center which supplement and complement the educational programs of the School of Medicine and Health Sciences.

Specialized information services are provided through computerized on-line bibliographic services which access a multitude of bibliographic and information data bases including MEDLINE, produced by the National Library of Medicine (NLM). Himmelfarb Library is an active participant in NLM's Regional Medical Library Program which facilitates interlibrary borrowing to meet the needs of users for materials not available within their library's collection.

Through formal class presentations and instruction provided on an individual basis, library staff instruct users in effective use of materials and research strategies to meet specific information needs. Special student services include an extensive collection of reserve materials designed to assist students with curriculum needs. In addition, the Library works closely with the Office of Education to provide materials to assist students with their educational planning.

The Himmelfarb Library, located adjacent to Ross Hall, can accommodate approximately 400 users. Facilities include a smoking lounge, a typing room, a conference room, group study rooms, and individual study carrels.

The George Washington University Hospital

This 550-bed hospital, including the Eugene Meyer Pavilion and the Harry F. Duncan Pavilion, is adjacent to the School of Medicine and Health Sciences. It is the primary clinical teaching facility for the students and for a large house staff. It is fully approved and accredited by the American Medical Association, the American Hospital Association, the American College of Physicians, and the American College of Surgeons, through the Joint Commission for the Accreditation of Hospitals. Annual patient admissions number approximately 20,000.

The Watson Wise Emergency Pavilion of the hospital logs approximately 40,000 patient visits annually and is one of the city's most active emergency units.

The University Hospital is equipped to serve 16 specialty fields. Complex teamwork procedures such as renal dialysis, a computerized x-ray unit for diagnosing brain diseases, cardiac catheterization, open-heart surgery, transplant surgery, and total hip replacements are included in its activities. Facilities include a surgical suite of 10 rooms, two of which are equipped with overhead galleries where observers may communicate with the surgical teams, observe

the electronic patient-monitoring system in action, and view the intricate surgical procedures below.

The Helen L. and Mary E. Warwick Memorial Building

This building houses a computerized multitest facility that is available to physicians for patient evaluation.

The Medical Faculty Associates

The Medical Faculty Associates are housed in the 13-story H.B. Burns Memorial Building, where ambulatory care is consolidated and integrated within the teaching program. The academic group practice of physicians in general medicine and in more than 20 specialties is based in the Burns Building. Visits of ambulatory patients number approximately 90,000 annually.

Affiliated Hospitals

Children's Hospital National Medical Center—Children's Hospital represents the Department of Child Health and Development at George Washington University School of Medicine and Health Sciences and offers a comprehensive clerkship experience for third-year students and a variety of elective opportunities in the fourth year. The hospital provides primary and tertiary care to children in the greater Washington area and is a referral center for children throughout the world.

Fairfax Hospital—This 656-bed voluntary community teaching hospital, part of a three-hospital system, serves a burgeoning suburban area and provides all clinical services including psychiatry. Each year more than 31,000 patients are admitted for treatment, 6,200 babies are delivered, 21,300 surgical operations are performed, and 60,000 persons are examined and treated in the Emergency Suite. Fairfax Hospital offers a rotating internship program, a School of Medical Technology, and clinical facilities for a School of Practical Nursing. Students of the School of Medicine and Health Sciences serve at this hospital in clinical clerkship and elective programs. Fairfax Hospital is an affiliated hospital for residency training in Obstetrics and Gynecology in the George Washington University Medical Center Program.

Holy Cross Hospital—Holy Cross, a modern 450-bed hospital, is a primary clinical campus which provides students with first-hand exposure to the practice of medicine in the community. It is a private, voluntary facility in which the full range of medical, surgical, and pediatric services is provided for a growing suburban population. Last year, more than 20,000 patients were hospitalized, nearly 43,000 emergency visits were registered, and 3,953 babies were delivered at Holy Cross. The hospital has consistently experienced one of the highest occupancy rates in the Metropolitan area.

National Naval Medical Center—The National Naval Medical Center, Bethesda, Maryland, is a 500-bed general hospital offering a wide range of specialized services, clinical research, and educational programs. Medical care is provided to active duty and retired military members and their dependents. It is a major referral center for thoracic and cardiovascular surgery as well as for cancer therapy. The teaching staff directs internship, residency, and fellowship programs in 25 specialties.

Saint Elizabeths Hospital—Saint Elizabeths Hospital, established by an 1852 Act of Congress, is a federal psychiatric hospital funded by and administered under the Department of Health and Human Services. This hospital provides for the treatment and care of approximately 5,000 persons, largely residents of the District of Columbia, of whom approximately 1,600 are inpatients in residence at any time. The Hospital staff includes a variety of specialists and support personnel that enable it to conduct psychiatric evaluations and deliver treatment using a wide range of therapeutic modalities. The hospital maintains an up-to-date health sciences library.

Medical students of George Washington University use the facilities of Saint Elizabeths for part of their clinical psychiatric training. A continuing research program is conducted at the hospital under a cooperative arrangement with the National Institute of Mental Health.

Veterans Administration Medical Center—In addition to medical, surgical, psychiatric, neurological, tubercular, and physical medicine and rehabilitation services, this 708-bed medical center has a large outpatient program; an extensive medical research program; programs in open-heart surgery, cobalt therapy, and renal dialysis; a metabolic program; and a specially designed Administrative Research Laboratory.

Washington Hospital Center—This 910-bed private, not-for-profit institution serves the greater Washington area through patient care, teaching, and research. The Center is the busiest hospital in the area, with approximately 30,600 admissions each year. An active emergency department treats more than 44,000 patients annually, while a separate facility for acute resuscitation of critically ill and injured patients treats another 1,000 each year. A 74-bed intensive care tower supports not only the trauma and medical services but also the very active cardiology and open-heart surgery programs and the area's only adult burn service. The center offers approved postgraduate programs in all specialties except psychiatry and pediatrics for 205 residents and fellows. Additionally, clinical rotations or teaching programs are provided for nurses, medical technologists, x-ray technicians, and numerous other allied health professionals.

Committees 1981–82

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J.M. Giordano *(Chairman)*, H.H. Ammerman, B.L. Bean, D.W. Delaney, D. Ein, B.T. Katzen, A. Mondzac, Y.C. Oertel, D.S. O'Leary *(ex officio)*, T.E. Piemme, V.A. Portnoi, H.M. Silver, G.P. Thomas, A.G. Wasserman

EDUCATIONAL EVALUATION

J.C. Rios *(Chairman)*, L.F. Affronti, B.C. Blatt, L.T. Bowles *(ex officio)*, B.L. Frankel, G. Gabe, B.J. Gaffney, L.L. Gallo, J.M. Giordano, F.C. Green, M.J. Jackson, R.I. Keimowitz, S.M. Knoll, A.M. Kwart, J.W. Larsen, J.J. Rheingold, J.M. Rosenstein, W.H. Scott, O.L. Silva, J.A. Straw, C.W. Thompson, R.S. Wilkinson, A.C. Wyman

EDUCATIONAL PLANNING

W.W. Olmsted *(Chairman)*, J.K. Barber, P.S. Birnbaum, L.K. Davies, O.W. Donnelly, L.W. Greenberg, K.Y. Huang, S.A. Karmi, R.J. Katz, R.I. Keimowitz, J.C. LaRosa, R.A. Levine, H.G. Mandel, G.F. Molinari, J. Orenstein, L.G. Pawlson, W.H. Scott, R.F. Shesser, R.S. Snell, C.T. Spiegel, H.H. Trout, G.A. Walker, D. Watkins, B. Waxman, J.M. Wise

EXECUTIVE COMMITTEE OF THE MEDICAL CENTER FACULTY SENATE

J.C. Rios *(Chairman)*, P.S. Birnbaum, V.H. Cohn, R.N. Edelson, R.P. Kaufman *(ex officio)*, W.W. Olmsted, R.S. Snell

GRADUATE MEDICAL EDUCATION

S. Perlin *(Chairman)*, M.F. Armaly, C. Davis, A.H. Einhorn, M.L. Elgart, A. Friedman, R.I. Keimowitz, S.G. Kent, S. Kirson, A.I. Kobrine, M.W. Lichtmann, H.C. Miller, G.F. Molinari, R.J. Nevaiser, D.W. O'Leary *(ex officio)*,

W.W. Olmsted, W.H. Scott, P.E. Shorb, Jr., S. Silverberg, L.E. Swanberg, A. Stone, R.J. Van Houten

LONG RANGE PLANNING

H.C. Miller, Jr. *(Chairman)*, J.P. Adams, L.F. Affronti, M.F. Armaly, P.S. Birnbaum *(ex officio)*, L.T. Bowles *(ex officio)*, C.S. Coakley, D.O. Davis, M.L. Elgart, A.L. Goldstein, M. Head, R.P. Kaufman *(ex officio)*, R.A. Kenney, H.G. Mandel, J.J. McFarland, Jr., G. Molinari, D.S. O'Leary *(ex officio)*, J.E. Ott, R.H. Parrott, J.C. Rios, H.V. Rizzoli, H. Sidransky, R.S. Snell, N.T. Tsangaris, A.B. Weingold, J.M. Wiener, W.S. Yamamoto

MEDICAL SCIENCES GRADUATE PROGRAMS

A. Kumar *(Chairman)*, S. Bloom, L.T. Bowles *(ex officio)*, V.H. Cohn, W.C. Eckelman, J.K. Kelleher, P. Klubes, M. Reich, F.J. Slaby, H. Solomon, B.W. Smith

PUBLIC RELATIONS

R.A. Kenney *(Chairman)*, C.J. Bier, P.S. Birnbaum *(ex officio)*, D. Borenstein, F.J. Kavanaugh, G.E. Wagner

RESEARCH

R.K. Riegelman *(Chairman)*, L.T. Bowles *(ex officio)*, E.W. Bradley, C.T. Garrett, D.J. Goodenough, K.E. Johnson, A. Kumar, P.D. Kind, F. Leonard, S. Levine, P. Mazel, J.E. Ott, S.D. Pett, A.M. Ross, G. Rosenquist, J.R. Shapiro, G.L. Simon, R.J. Stillman, R.J. Walsh

STUDENT AFFAIRS

A. Segal *(Chairman)*, B.L. Bean, L.T. Bowles, W. Cooper, L.L. Gallo, M. Gusack, R.I. Keimowitz, S.G. Kent, J.M. Pisani, W.H. Scott, D.B. Simon, G.E. Wagner, J.M. Wiener

Alumni and Allied Associations

THE GENERAL ALUMNI ASSOCIATION

The objectives of this association are to unite graduates who wish to associate themselves for charitable, educational, literary, and scientific purposes, and to promote the general welfare of the University.

Eligible members are those who have enrolled in any school of the University and who have left the University in good standing, or any person who is or has been a member of the teaching, research, or administrative staff of the University, or of the Board of Trustees of the University.

The affairs of the Association are directed by a Governing Board, the majority of whose members represent the constituent alumni organizations of the University's schools and colleges.

The voluntary leadership of the Association works closely with the staff of the Alumni Relations Office in carrying out Association affairs. The Association may be contacted through the Alumni Relations Office.

THE GEORGE WASHINGTON UNIVERSITY MEDICAL ALUMNI ASSOCIATION

The George Washington University Medical Alumni Association, incorporated in 1959, continues the organization previously known as the George Washington University Medical Society.

The stated purposes of the Association are as follows: "This shall be a non-profit organization international in scope, whose objectives shall be to provide constructive services for the M.D. degree alumni of the George Washington University School of Medicine and Health Sciences for furthering the art and science of medicine, research, and for the promotion of the welfare of the George Washington University School of Medicine and Health Sciences, its students, the George Washington University Hospital and its trainees."

Active membership in the Association consists of all M.D. degree graduates of the School of Medicine and Health Sciences; current members and, on application, past members of the teaching staff of the School of Medicine and Health Sciences who hold doctoral degrees; and doctors of medicine who have had one or more years of postgraduate training in the George Washington University Hospital. Junior membership consists of all members of the student body of the M.D. degree program of the School of Medicine and Health Sciences.

The Medical Alumni Association maintains an office in the School of Medicine and Health Sciences.

Officers for 1981–82

President—William H. Cooper, M.D. 1949
President Elect—Allan Zellis, M.D. 1941
First Vice President—William Schewe, M.D. 1943
Second Vice President—Harry C. Beaver, M.D. 1963
Secretary—Robert Wineland, M.D. 1951
Treasurer—John Lyles, M.D. 1970

Council:

Marvin Footer, M.D. 1942
Sidney Levine, M.D. 1941
Leon Levitsky, M.D. 1954
John Mermel, M.D. 1960
Stephen Pappas, M.D. 1956
Dee R. Parkinson, M.D. 1943
Alvin Parrish, M.D. 1945
Julius Piver, M.D. 1952
John Umhau, M.D. 1952
Allan Zellis, M.D. 1941



THE DOCTOR OF MEDICINE DEGREE PROGRAM

ADMISSION

The George Washington University School of Medicine and Health Sciences seeks to enroll intellectually gifted, humanly sensitive, mature persons who will excel in the science and art of medicine. Applicants of diverse social and educational backgrounds have access to the admissions process. In the selection process there is no discrimination because of sex, race, color, religion, age, marital status, national or regional origin, or handicap.

Entrance Requirements

ADMISSION TO THE FIRST-YEAR CLASS

For admission to the Doctor of Medicine degree program, a minimum of 90 semester hours must have been earned in an accredited American or Canadian institution of higher learning. Credits earned in a professional school can be applied to the fulfillment of this minimum requirement only if they are acceptable by the applicant's college or university toward a bachelor's degree in arts or science. (A credit under the quarter system is two-thirds of a semester hour.) It is advantageous to complete four full years of undergraduate study. Only exceptional students are accepted upon completion of the minimal requirements.

It is possible for exceptional students with three years of undergraduate work in Columbian College of George Washington University to be admitted to this medical school and to receive a combined Bachelor of Arts-Doctor of Medicine degree. More detailed information on this program is given on page 31.

The following courses must be completed with satisfactory achievement before the applicant can be certified for matriculation. All required science courses must include sufficient laboratory work to give assurance of familiarity with the experimental methods and techniques of the disciplines.

1. **Biology:** Eight semester hours, including two semester hours of laboratory. This may be either in general biology or zoology, but may *not* include separately credited courses in botany.

2. **Chemistry:** Eight semester hours of general inorganic chemistry (which may include qualitative analysis), including two semester hours of laboratory; six to eight semester hours of organic chemistry, including laboratory.

3. **Physics:** Eight semester hours, including at least two semester hours of laboratory.

4. **English:** Six semester hours in composition and literature. This may be the usual introductory college course or its equivalent.

The number of required courses has been kept to a minimum in order to allow college students the time to pursue their own interests in depth. The Admissions Committee has no preference with regard to the major area of study of the applicant. Students with backgrounds in the arts, humanities, and social sciences are as admissible as applicants with science backgrounds. The Committee does expect that work in the student's chosen area of concentration as well as in the required science courses should reflect scholarly interests and show evidence of significant achievement.

ADMISSION WITH ADVANCED STANDING

A number of recent developments require further deliberation by the Faculty before an appropriately revised policy on advanced standing can be articulated. At the time of printing of this *Bulletin*, this review was not complete. Interested applicants are invited to write to the Office of Admissions of the School of Medicine and Health Sciences for final regulations.

Application Procedure

APPLICATION TO THE FIRST-YEAR CLASS

Application forms are available from the Office of Admissions. All applicants are reminded that the submission of materially false or misleading information in application forms or in connection with the application process shall be grounds for rejection. If such submission is discovered after entrance into the School or award of a degree, it shall be grounds for dismissal or for revocation of the degree.

The School is a participant in the American Medical College Application Service (AMCAS). Applications for a place in the first-year class can be obtained only from AMCAS, 1776 Massachusetts Avenue, N.W., Suite 301, Washington, D.C. 20036. When completed, this application is returned to AMCAS for distribution to schools selected by the applicant. The AMCAS application deadline is November 1 of the year preceding that for which admission is sought.

After receipt of our copy of the AMCAS application, the Office of Admissions will send applicants a Supplemental Application. This requests information not included on the AMCAS application. Submission of this supplemental application (due no later than December 15), including the nonrefundable supplemental application fee ($30), will initiate Admissions Committee processing of the application. On the basis of available information some applicants will be asked to have letters of evaluation (recommendation) sent. After careful review of these documents the committee will extend an invitation for interview to the most promising candidates. When these steps are completed, the application will be brought to the Admissions Committee for final decision. Applicants will be informed of final decisions immediately. Although it does not assume an obligation to report missing or erroneous credentials, the Admissions Office will try to contact the applicant if it is noted that necessary credentials are missing.

This institution also participates in the AMCAS Early Decision Program. Interested applicants are referred to the AMCAS Information Booklet included with the AMCAS application materials. Early decision applicants should be aware that they must submit their application by August of the year preceding that for which admission is sought, and that for consideration, the supplemental application and all letters of recommendation and transcripts must be received by the Office of Admissions no later than September 1. Decisions on early decision candidates are usually made by October 1 and no later than October 15.

Applicants are referred to the AMCAS information booklet and to the admissions brochure available from the Office of Admissions, School of Medicine and Health Sciences, for the most up-to-date information available at the time of application. Details included in those sources supersede information contained herein.

APPLICATION WITH ADVANCED STANDING

Information and applications for admission with advanced standing should be obtained from the Office of Admissions (M.D. Program), School of Medicine and Health Sciences, 2300 Eye Street, N.W., Washington, D.C. 20037.

All applicants must complete an advanced standing application form and submit it with a $30 application fee no later than June 1.

Selection Procedures

To process the vast number of applications to this institution fairly and expeditiously, a screening evaluation system is utilized. This evaluation procedure screens applicants on the basis of undergraduate grades (taking into account improvement in performance in later years), Medical College Admission Test scores, and pertinent extracurricular and work experiences. Some additional consideration is given to applicants from the District of Columbia and the neighboring metropolitan area, as well as to applicants from George Washington University. There are no age limits.

When all credentials and interview reports are available, the application is reviewed by the Admissions Committee. In this review, although grades and MCAT scores are considered, major consideration is given to the essay portions of the applications, the letters of evaluation, and the interview reports, in an attempt to assess those motivational and personal characteristics that the committee feels are important in choosing future physicians.

Applicants who are offered a place in the class are required, within two weeks, to notify the Office of Admissions (M.D. Program), School of Medicine and Health Sciences, in writing, of their intent to accept the places reserved for them. A deposit of $100 is also required by a specific date after notification of acceptance. The date will be given in the notice of acceptance. The deposit becomes nonrefundable two weeks prior to registration but will be credited toward the first semester's tuition.

PROGRAM OF STUDY

The faculty and administration of the School of Medicine and Health Sciences have developed a curriculum designed to prepare each student for a

professional life of continuous learning. Because students differ in background, ability, and career interests, the curriculum is balanced with required courses, and students are encouraged to maximize achievement within their own limits. It is presumed that all graduates will seek additional education in graduate training programs before assuming complete responsibility for independent clinical decision-making.

In the first year, the student concentrates primarily on basic sciences. The course of study includes anatomy and biochemestry in the first semester. In the second semester, the student concentrates on physiology and microbiology in addition to an integrated course in neurobiology.

Freshman and sophomore medical students are permitted to register for electives for credit or use elective time at their discretion. The first two weeks of an elective are probationary, to enable students to decide whether it is suited to their needs. After completing the first two weeks of an elective, students are committed to complete the course requirements.

The second year integrates basic science and clinical information. Pathology and pharmacology provide the major basic science substrates. This academic program has been evolving since 1970 and several innovations have been introduced each year. The course is coordinated by a program director. Integration is accomplished through the work of faculty subcommittees working with the program director and the second-year subcommittee on educational planning. Medical students are introduced to physical diagnosis during the first semester of the second year.

The final two years form a two-year continuum of required clerkships and elective sequences, designed to bring the student to optimal readiness for graduate training. Clerkships are required in medicine, surgery, pediatrics, obstetrics-gynecology, psychiatry, and health care sciences. Each student must



complete a 4-week acting internship in one of the following: medicine, pediatrics, or family medicine. In addition, each student must take a 2-week clerkship in anesthesia and *two* 2-week clerkships from among the following: orthopaedics, urology, neurosurgery, or plastic surgery.

A variety of elective experience is available at the University and its affiliated hospitals; permission may be granted to take electives elsewhere.

During the entire educational experience, students are encouraged to assume responsibility for their self-assessment and continued learning. It is the goal of the faculty to select and educate concerned human beings who will function productively and effectively during a long career in medicine.

DEGREE REQUIREMENTS

Every candidate for graduation with the degree of Doctor of Medicine must have satisfactorily completed the requirements of the School of Medicine and Health Sciences as described above, including no less than four academic years of study as a matriculated student in medicine or the equivalent. All required courses must be completed and all prescribed examinations satisfactorily passed.

HONORS

Candidates who have completed the four-year course for the Doctor of Medicine degree and have received the grade of *H* (Honors) in courses totalling 50 per cent or more of the total number of semester hours taken may be recommended by the Executive Committee of the Medical Center for graduation "With Distinction."

COMBINED DEGREE PROGRAMS

Combined Bachelor of Arts and Doctor of Medicine

To be recommended for the degree of Bachelor of Arts, the candidate must complete at least 94 semester hours of prescribed college work (at least 30 hours and one year of residence must be completed in Columbian College of Arts and Sciences) and the first year of the medical curriculum. Upon satisfactory completion of the fourth year of the medical curriculum the student becomes eligible for the degree of Doctor of Medicine.

It should be understood, however, that admission to Columbian College does not guarantee admission to the School of Medicine and Health Sciences.

Combined Master of Science and Doctor of Medicine

The departments of the School of Medicine and Health Sciences cooperate with the Graduate School of Arts and Sciences in offering programs leading to the combined degrees of Master of Science and Doctor of Medicine in the fields of biochemistry, genetics, microbiology, mycology, pharmacology, and physiology.

Students in the School of Medicine and Health Sciences who wish to apply for the combined degrees of Master of Science and Doctor of Medicine must meet the requirements for admission to the Graduate School of Arts and Sciences.

They must be recommended by the chairman of the department and by the Dean of the Graduate School of Arts and Sciences and the Dean for Academic Affairs of the Medical Center.

The Master of Science degree program consists of a minimum of 30 semester hours which includes a thesis (equivalent to six semester hours). For a Master of Science degree program which does *not* include a thesis, the number of semester hours of graduate course work is determined by the department. The program without the thesis is not an individual student option and is not available in every department.

A maximum of 12 semester hours of credit for graduate-level courses *completed as a part of the Doctor of Medicine degree* (and not already applied toward the bachelor's degree) will be allowed in fulfillment of the requirements of the Master of Science degree. The remaining semester hours of work, including a thesis if it is required, must be in course work in the basic medical sciences normally required for a Master of Science degree in the Graduate School of Arts and Sciences.

Dual Program for the Doctor of Medicine and Doctor of Philosophy Degrees

In cooperation with the Graduate School of Arts and Sciences a dual program is available to qualified students who seek both the Doctor of Medicine and Doctor of Philosophy degrees. The requirements which must be fulfilled for both degrees are identical to those currently and separately established in the School of Medicine and Health Sciences and the Graduate School of Arts and Sciences.

To enter the dual degree program, a prospective student first must apply for and gain admission to both the Graduate School of Arts and Sciences and the School of Medicine and Health Sciences separately through established procedures. Upon admission to both schools, the student may then apply for affiliation with the dual degree program. Work toward the Doctor of Philosophy degree is performed under the jurisdiction of a *departmental* doctoral committee and is available in more than 50 research fields.

A student working toward these degrees may apply a maximum of 24 semester hours of approved work taken in the M.D. degree program of the School of Medicine and Health Sciences toward the total of 72 semester hours required to complete the requirements for the Doctor of Philosophy degree. Twenty-four hours of this requirement must be earned in graduate courses during periods when the student is not obligated to full-time enrollment in the M.D. degree program, i.e., during summer sessions, vacation periods, etc. The final 24 semester hours of dissertation research toward the Doctor of Philosophy degree may begin concurrently with the final semester of graduate course work. The estimated time for completion of this dual program is six years.

Master of Science and Doctor of Philosophy Requirements

The detailed requirements for the degrees of Master of Science and Doctor of Philosophy are stated in the *Undergraduate and Graduate Bulletin* of the University, which is available at the Graduate School of Arts and Sciences, George Washington University, Washington, D.C. 20052.

REGULATIONS FOR M.D. CANDIDATES

Attendance

A student is not permitted to attend classes until registration has been completed and fees due have been paid. Regular attendance is required.

Grades

H (Honors); *P* (Pass); *F* (Fail); *CN* (Conditional); *IP* (In Progress); *I* (Incomplete); *W* (Withdrawal); *X* (Exempt).

H (Honors)—Those students whose performance in a subject as determined by the department concerned is of a very high caliber, and who, *in addition*, have demonstrated those qualities of intellectual curiosity, integrity, and self-discipline which clearly set them apart from the majority of the group, may be assigned the grade of *H* (Honors).

P (Pass)—All students, with the exception of those specifically defined above, whose performance in a subject meets the minimum requirements established by the department concerned, shall be assigned a grade of *P* (Pass).

F (Fail)—Those students whose performance in a subject as determined by the department concerned is of such a low caliber that a satisfactory level of performance could not reasonably be expected to be attained by a program of guided study developed by the department shall be given a grade of *F* (Fail).

A grade of *F* requires that the student repeat the course at this or some other institution approved by the department and the Dean for Academic Affairs prior to proceeding to the work of the following year. Upon completion of such a course with a grade of *P* (Pass) or its equivalent, the student shall be permitted to continue in the M.D. program and the grade of *F* converted to *F/P*.

CN (Conditional)—Those students who do not meet the minimum requirements established by the department concerned but who could reasonably be expected to do so through a program of remedial work to be developed by the department and approved by the Committee on Educational Evaluation shall be assigned the grade of *CN* (Conditional). The grade of *CN* is not a passing grade and must be upgraded prior to beginning the next academic year or, in the case of clinical subjects, prior to graduation. Upon certification by the department that the student has attained suitable proficiency in the subject, as evidenced by examination or such other criteria as may be appropriate, the student shall be permitted to continue in the M.D. program and the grade of *CN* converted to *CN/P*.

A student may, in lieu of such a program, elect to repeat the course at this or any other institution which is approved by the department concerned. A grade of *P* (Pass) or better shall then result in conversion of the *CN* to *CN/P*.

Failure to upgrade a *CN* to *CN/P* by one of these procedures within the prescribed period shall result in the automatic conversion of the *CN* to *CN/F*.

IP (In Progress)—The grade of *IP* will be assigned to students in courses which require more than one semester for completion. A grade will be assigned upon completion of the entire course in a subsequent semester.

I (Incomplete)—The grade of *I* will be assigned when a student fails to com-

plete all the required work in a course for reasons acceptable to the Dean for Academic Affairs. A student in the first or second year may not proceed into the work of the following year until a grade of *I* has been removed; if not removed, a grade of *I* will be changed automatically to a grade of *F* (Fail) after one year. A student in the third or fourth year must remove a grade of *I* prior to graduation.

W (Withdrawal)—The grade of *W* will be assigned only when a student is unable to continue in school for reasons acceptable to the Dean for Academic Affairs. Such reasons may *not* include scholarship. The student may be readmitted at the discretion of the Dean for Academic Affairs, within a period of two years, and may repeat for credit the course or courses in which the grade of *W* had been assigned.

X (Exempt)—The grade of *X* is an administrative grade issued by the department to students "exempt" from a required course; it is awarded on the basis of previous work taken or a waiver examination.

Grading of First- and Second-Year Electives

The first two weeks of an elective in the first and second year are probationary to enable students to decide whether it is suited to their needs. After completing the first two weeks of an elective, the student is committed to complete the course requirements and each elective shall be graded on a Pass/Fail system with the grade *P* or *F* recorded on the student's transcript. Distinguished performance should be recognized by sending a letter to the Dean for incorporation into the student's file.

Definition of Good Academic Standing

A student is considered in good academic standing until such time that he or she is formally dismissed from the Doctor of Medicine degree program. In other words, for those programs that require a statement of good academic standing from the institution, such a statement will be forthcoming on any student unless he or she is formally dismissed from the Doctor of Medicine degree program of the School of Medicine and Health Sciences.

Academic Probation and Academic Dismissal

On recommendation of the Educational Evaluation Committee, the Dean for Academic Affairs may place a student on academic probation or dismiss him or her from the M.D. program. The Educational Evaluation Committee shall make its recommendations after careful and individual review considering the total number of credit hours of *CN* and *F* grades in required courses and required elective courses attained by the student during the M.D. program, without regard to whether these grades have been upgraded by further study; except that in the case of a student who has been permitted to repeat a year, the initial grades will not be included in this total.

Academic probation and academic dismissal may be recommended by the Educational Evaluation Committee under the conditions described below.

Academic Probation—A student who receives grades of *F* in courses totaling six or more semester hours, or a combination of grades of *F* and *CN* in

more than six semester hours in one semester, shall be placed on academic probation for the following semester. A student who, while on probation, receives a grade of *F* or *CN* in any course will be continued on probation for the following semester. A student who, through action of the Educational Evaluation Committee and the Dean for Academic Affairs, has been permitted to repeat a year shall be placed on academic probation. All students on academic probation shall be reviewed by the Educational Evaluation Committee at the end of their probational periods.

Academic Dismissal—A student (1) who is on academic probation for four or more semesters, consecutive or otherwise; or (2) who receives grades of *F* in courses totalling 14 or more semester hours in any academic year; or (3) who receives grades of *CN* or *CN* and *F* combined in courses totaling more than 20 semester hours of work in any academic year; or (4) who receives grades of *F* in more than 20 semester hours of work in the M.D. program, or (5) who receives grades of *CN* or *CN* and *F* combined totaling more than 30 semester hours of work in the M.D. program; or (6) whose knowledge and clinical competencies have not achieved, in the judgment of the Educational Evaluation Committee, a satisfactory level of development and integration at any stage of training to justify continuing him or her as a reasonable candidate for the M.D. degree will be subject to dismissal from the M.D. degree program. (See also section on Evaluation of Non-Academic Competence.)

Evaluation of Non-Academic Competence

To assure the safety of the public, the institution reserves the right to dismiss from the M.D. program any student whose behavior is clearly unacceptable for or would be dangerous in the practice of medicine. Since it would be impossible to catalogue all behaviors which might raise serious question as to the student's competence to continue in medical school, a process has been established to deal with problems in this domain. Safeguards have been taken to prevent this from becoming a mechanism to discourage deviation from social norms, or to suppress personal or political expression. It is carefully designed to protect any student from discrimination on the basis of his or her beliefs or personal behavior where these are not likely to be dangerous to the public should the student become a physician.

Upon receipt of a written complaint about a student, the Dean for Student Affairs would inform the student and conduct a confidential inquiry. Possible dispositions would be to advise the student, to drop the matter entirely, or to refer it on to a subcommittee of the Educational Evaluation Committee. Two of the subcommittee's four members would be medical students. The subcommittee's proceedings would also be confidential, and would result in advising the student, dropping the matter, or referring it on to the Educational Evaluation Committee. Its recommendations might be to discontinue the inquiry, to place the student on probationary status (which would be carefully defined), or to dismiss the student from the M.D. program. At every stage, the student would have the right of appeal.

Any interested person may receive a copy of the complete regulations for students in the M.D. program from the Admissions Office or from the Office of the Dean for Academic Affairs.

Examinations

Examinations, which may be written, oral, or practical, will be held during and/or at the end of each semester.

Graduation

Graduation follows satisfactory completion of the course of study, and does not imply the acquisition of a set number of credit hours.

Application for Graduation—Application for graduation must be filed in the Office of the Dean for Academic Affairs, and the fee must be paid at the time of registration for the last semester of the fourth year.

Presence at Graduation—A candidate is required to be present at the graduation exercises unless written application for graduation *in absentia* is approved by the Dean for Academic Affairs.

FEES AND FINANCIAL REGULATIONS FOR M.D. CANDIDATES

The following fees have been established for the 1982–83 academic year.*

Application fee	$30.00
Tuition fee, for the academic year for 1st-year medical students	19,000.00
Tuition fee, for the academic year for 2nd-, 3rd-, and 4th-year medical students	16,750.00
University Center fee, charged all students (except those granted "leave of absence" status) each semester	60.60
Late registration fee, for failure to register within the designated period	15.00
Late payment fee, charged for failure to make payments when due (see "Payment of Fees," below)	15.00
Financial reinstatement fee, for reinstatement after financial encumbrance for nonpayment of fees (see "Payment of Fees," below)	35.00
Graduation fee	25.00
Returned check fee, charged a student whose check is improperly drafted, incomplete, or returned by the bank for insufficient funds or for any other reason	15.00
Transcript fee	2.00
If two or more transcripts are requested at the same time, fee for the first two copies is $2 each, fee for each additional copy	.50
Replacement of lost or stolen picture identification card	2.00

Payment of Fees

The annual tuition fee for the academic year is payable in two equal installments on or before registration day for each semester. M.D. students who register during the summer for courses offered in other divisions of the University will be charged the regular summer tuition and other fees. No tuition will be charged M.D. students for Medical School clerkships elected by the student during the summer between the second and third years. No additional tuition will be charged third-year students for courses taken anywhere in the Univer-

* For courses offered in other divisions of the University, the following 1982 Summer Sessions fees apply for each semester hour: Tuition $160.00; University Center fee, $5.75.

sity during the summer prior to registration as a fourth-year student. No student is permitted to complete registration or attend classes until all charges are paid or until arrangements for payment have been made. Tuition and fees are payable at the Office of the Cashier of the University. Checks should be made payable to George Washington University, with student identification number shown in the upper left-hand corner.

The Student Accounts Office has responsibility for billing and maintaining student accounts for tuition, various fees, and room and board charges. While tuition is due and payable in full as described above, students may sign a deferred payment contract with the Student Accounts Office at the time of registration permitting them to pay one-half of the total tuition and fees (except for fees payable in advance) at the time of registration and the remaining half on or before Wednesday of the eighth week of classes for the fall and spring semesters. Interest at the rate of eight per cent per annum on the unpaid balance will be charged from the date of registration to the date payment is made. A 10-month payment plan is also available.

Students receiving tuition assistance in the form of scholarships, government tuition contracts, or other forms of tuition awards are not permitted to sign deferred payment contracts unless the total tuition and fee charges exceed the value of the tuition awards by $1,500 or more per semester. Under such circumstances the student may be permitted to pay one-half of the amount due from the student at the time of registration and to defer the balance by signing a deferred payment contract.

Students who fail to make any payment when due will be automatically charged a $15 late payment fee and will be subject to the interest charge of eight per cent per annum. Accounts which become 30 days past due will be financially encumbered. In the event a student's account is financially encumbered, the student forfeits rights to the use of the deferred payment contracts in future semesters, and the Student Accounts Office will notify the Registrar to withhold grades, future registration privileges, transcripts, diplomas, and other academic information until the account is settled financially. Financial settlement will require payment in full of all amounts due the University in addition to a financial reinstatement fee of $35.

After entering the course of instruction the student is obligated for the tuition for the full semester. A student registered for medical electives in the summer session between the second and third year is obligated for tuition due at the time of registration for the following fall semester, except that in the case of withdrawal or leave of absence a *pro rata* payment will become due immediately.

Acceptance by the University of a student's fees does not in any way obligate the School of Medicine and Health Sciences to accept the student for any subsequent semester or summer session, and the right is reserved to require the withdrawal of any student whenever, in the interest of the student or the School, the Executive Committee of the Medical Center deems it advisable to do so.

Cost of Textbooks and Student Equipment

It is estimated that the minimum cost of necessary textbooks and student equipment (microscope, drawing materials, glass slides, clinical thermometer, stethoscope, hemocytometer, uniforms, etc.) is approximately as follows: first year, $800; second year, $950; third year, $350; and fourth year, $200. Microscopes must be provided by the student. Rentals are not available from the School.

Prepaid and Deferred Payment Plans

Several commercial programs for those who wish to pay for college on a monthly basis are available. Terms and conditions vary, but most provide a life insurance policy in the contract. For specific details and applications, address inquiries to the following:

1. Girard Edu-Check Plan, 2nd and Chestnut Streets, Philadelphia, Pa. 19106
2. Richard C. Knight Insured Tuition Payment Plan, 6 St. James Avenue, Boston, Mass. 02100
3. The Tuition Plan, Inc., Concord, N.H. 03301

The University's Office of Student Financial Aid does not maintain a supply of applications for these various programs, but will be happy to provide guidance to students and parents.

Withdrawals and Refunds

Applications for withdrawal from the University or for change in class schedule must be made in person or in writing to the dean. Notification to an instructor is not an acceptable notice.

In authorized withdrawals and changes in schedule, cancellations of semester tuition charges and fees will be made in accordance with the following schedule for the fall and spring semesters:

Complete withdrawal from the University:

Withdrawal dated on or before Saturday of the first week of classes 90%
Withdrawal dated on or before Saturday of the third week of classes 75%
Withdrawal dated on or before Saturday of the fifth week of classes 50%
Withdrawal dated after the fifth week of classes .....none

Regulations governing student withdrawals as they relate to apartment and food service charges are contained in the specific lease arrangements.

Refund policies of the University are in conformity with guidelines for refunds as adopted by the American Council on Education.

In no case will tuition be reduced or refunded because of absence from classes.

Authorization to withdraw and certification for work done will not be given a student who does not have a clear financial record.

Students are encouraged to provide their own cash funds until they can make banking arrangements in the community.

FINANCIAL AID

The following fellowships, scholarships, and loan funds are available to students in the School of Medicine and Health Sciences. Unless otherwise specified, inquiries should be directed to the Financial Aid Office of the Medical Center, George Washington University, 2300 Eye Street, N.W., Washington, D.C. 20037.

Fellowships

Wilbur J. and Edith K. Carr Memorial Fellowship Fund (1965)—By bequest of Edith K. Carr, former trustee of the University. The income from this fund provides fellowships in surgery, medicine, or medical research at the George Washington University Hospital.

Samuel Jordan Graham Fellowship in Surgery (1961)—By bequest, in memory of Judge and Mrs. Graham. The income from this fund, up to $2,000, may be used to assist students who are pursuing postgraduate study or research, preferably in surgery, at the School of Medicine and Health Sciences.

If no individual is conducting such work or deserving of the award, the income may be used to provide one or more scholarships (to cover tuition and other school expenses deemed appropriate) for students in the School of Medicine and Health Sciences. Application should be filed with the Chairman of the Department of Surgery no later than March 1.

Robin Miller Research Fellowship (1953)—A $3,000 fellowship established by bequest of Mrs. Robin Miller for the study of cardiovascular diseases.

Henry Rau Foundation Student Fellowship Grant (1967)—Awarded annually to a student in the School of Medicine and Health Sciences for research in cancer and allied diseases at the George Washington University Clinic.

U.S. Public Health Service Training Grants—Information concerning training grants in fields of the medical sciences is available at the Office of the Dean for Academic Affairs of the Medical Center.

Scholarships

Scholarships from University funds are offered to full-time students in the M.D. program on the basis of financial need and scholastic achievement. These awards are made for one academic year at a time and are credited directly to the student's tuition bill. Application forms are available upon request from the Financial Aid Office. The deadline for submission is March 15.

Achievement Rewards for College Scientists (ARCS) Foundation, Inc., Scholarship—Awarded to a student on the basis of financial need and superior grades. Candidates must be citizens of the United States.

Anna Bartsch Hospital Intern Scholarship (1946)—A partial scholarship established by Dr. Anna Bartsch-Dunne as a memorial to her mother. Awarded to a woman intern in the University Hospital.

Dr. Edith SeVille Coale Scholarships (1965)—Provided at the request of Dr. Coale for women in the School of Medicine and Health Sciences. The scholarships are administered by the Zonta Club of Washington. Application should be made to the Financial Aid Office of the Medical Center no later than December 1.

Joseph Collins Foundation Scholarships (1951)—Available to medical students upon application through the Financial Aid Office of the Medical Center.

Morris H. and Pauline L. Goldenberg Scholarship Fund (1979)—Created by gift of Dr. Morris H. (class of 1929) and Mrs. Pauline L. Goldenberg in memoriam for father and mother, the income from which will be used for needy and deserving medical students in the School of Medicine and Health Sciences. Preference will be given to students expressing an interest in the study of radiology.

The Garfield Kass Memorial Medical Scholarship (1979)—Established by his wife Rose. Awarded on the basis of financial need to a worthy student in the School of Medicine and Health Sciences.

Ki-Wives of Washington Scholarship Fund (1958)—Three scholarships available to students in the School of Medicine and Health Sciences.

Sidney A. Levine Scholarship Fund (1971)—Established to assist medical students on the basis of financial need and academic performance.

Medical Student Research Scholarships and Traineeships—For student participation in the research programs of the School of Medicine and Health Sciences or special training in research methods. Research scholarships are ordinarily awarded for full-time activity during the summer months; research traineeships support part-time work during the academic year. Scholars are "matched" with members of the faculty in accordance with their mutual interests. Trainees are designated by the departments responsible for the programs. These programs have been sponsored by the National Institutes of Health. In addition, a number of research scholarships have been made available through the Washington Heart Association.

Thomas M. Peery Scholarship (1974)—Awarded on the basis of financial need to a worthy student in the School of Medicine and Health Sciences.

Dan Pollin Medical Scholarship Fund (1980)—Awarded on the basis of financial need to a worthy student in the School of Medicine and Health Sciences.

School of Medicine Scholarship Fund (1968)—Established by gifts of various and anonymous donors to assist medical students.

Gordon Fay Willey Scholarship (1974)—Awarded to students whose parents are U.S. citizens who are or were enlisted men, non-commissioned officers, and officers below the grade of Major in the Army or Air Force or Captain in the Navy of the United States.

Winslow Foundation Scholarship (1974)—Available to medical students who are residents of Maryland, the District of Columbia, or North Carolina, on the basis of financial need.

School of Medicine and Health Sciences Scholarship Fund

Scholarship aid is awarded from income on endowments that have been established by gifts from various donors for tuition awards to students in the School of Medicine and Health Sciences. Listed below are the endowments that support the School of Medicine Scholarship Fund:

Anna Bartsch Scholarship Fund (1946)—Established by Dr. Anna Bartsch-Dunne as a memorial to her mother. Awarded to a woman in the School of Medicine and Health Sciences "of outstanding scholarship, character, and promise, who intends to make the practice of medicine her life profession."

Jack I. Bender Scholarship Fund (1967)—Established by the family of Jack I. Bender as a memorial to their father. Awarded annually to a student on the basis of academic performance and financial need.

Everett Lamont Bradley Scholarship Fund (1954)—By bequest of Alice R.H. Bradley in memory of her son, for a student in the School of Medicine and Health Sciences.

Elma B. Carr Scholarship Fund (1976)—Created from income distribution of the Elma B. Carr, M.D. Trust, the income to be used for scholarships in the School of Medicine and Health Sciences.

Oliver C. Cox Scholarship Fund (1973)—Established in memory of Dr. Oliver C. Cox, "for the establishment, support and maintenance of endowed scholarships in medicine."

Albert A. and Esther C. Jones Scholarship Fund (1981)—To be used to defray expenses including tuition, room and board, and books of worthy students for the teaching of science or medicine.

Barbara Logan, M.D. Scholarship Fund (1980)—Awarded annually to the third-year student who ranked among the top five students in the class during the first two years and who was experiencing the greatest financial need among those five.

Loughran Medical Scholarship (1976)—A partial scholarship established by the Mary and Daniel Loughran Foundation, Inc., for residents of the Washington metropolitan area. Such residency must have been established prior to the commencement of the recipient's undergraduate studies. Awarded 1978–79 and every third year thereafter.

David Perry Steinman Memorial Scholarship Fund (1960)—Established by friends and classmates. Awarded annually to a second-year student in the School of Medicine and Health Sciences on the basis of financial need and academic performance.

James J. Whisman Scholarship Fund (1966)—By bequest of James J. Whisman for needy and deserving students in the School of Medicine and Health Sciences.

Columbian Women Scholarship Funds

The Columbian Women Scholarships are awarded to women students on the basis of financial need and scholastic attainment. Candidates must have completed a minimum of 15 hours at this University with a minimum *B* (3.0) average, or the equivalent. A letter of application for these scholarships should be addressed to the Chairman, Columbian Women Scholarships, care of the Alumni Office, George Washington University, Washington, D.C. 20052, no later than May 15 for the fall semester, and January 1 for the spring semester. Scholarship aid is awarded from income of the following endowments:

Estelle M. Corbett Scholarship Fund (1973)—Created by gift of Elma Williams for tuition aid for a medical student.

Jessie Fant Evans Scholarship Fund (1967)—Established by bequest of Jessie Fant Evans, former Trustee of the University, for tuition aid.

Lewes D. and Myrtle H. Wilson Memorial Scholarship Fund (1926)—Established by Elizabeth Wilson, as a memorial to her parents, for tuition aid.

Loan Funds*

A.M.A. Medical School Loan Fund—Created in 1964 by the American Medical Association, to be loaned to students.

Doreen and Donald Brown Loan Fund—This fund has been established to provide aid to worthy and needy medical students.

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* See the George Washington University School of Medicine and Health Sciences *Financial Aid Handbook* for more complete information.

Morris and Gwendolyn Cafritz Foundation Loan Fund for Medical Students—Created in 1977 by the Morris and Gwendolyn Cafritz Foundation, to be loaned to students.

Carr Loan Fund—Created in 1962 by Edith K. Carr, to be loaned to students.

Carroll Memorial Loan Fund—Created in 1981 in memory of Dr. James Carroll and George S.H. Carroll, husband and son of Mrs. Marie W. Carroll.

Abraham I. Gimble Medical School Loan Fund—Created in 1977 by gift of Dr. Abraham I. Gimble, to be loaned to deserving and needy students.

Katharine Graham Medical School Loan Fund—Created in 1978 by gift of Katharine Graham, to be loaned to deserving and needy students.

Himes Loan Fund—Created in 1957 by Joseph H. Himes.

Kellogg Medical School Loan Fund—Created in 1942 by the W.K. Kellogg Foundation, to be loaned to students.

Dr. Esther A. Nathanson Memorial Medical Loan Fund—Created in 1977 in memory of Esther A. Nathanson, A.B. 1922, M.D. 1925, by her sister, Sadie C. Nathanson, to be loaned to deserving and needy students.

Pfizer Loan Fund—Created in 1953 by Charles Pfizer and Company, Inc., to be loaned to students.

School of Medicine Medical Student Loan Fund—Created in 1952 by School of Medicine students, and augmented by a bequest from the estate of Ethel L. Murray to be loaned to students.

Dr. and Mrs. A.E. Sommer Medical School Loan Fund—Created in 1981 by gift of Dr. A. Ellison Sommer, to be loaned to deserving and needy students.

Strauss Medical School Loan Fund—Created in 1975 by gift of Lewis H. Strauss and Mrs. Lewis L. Strauss in memory of Honorable Lewis L. Strauss, to be loaned to students.

Sutherland Loan Fund—Created in 1941 by gift of Rose L. Sutherland and other donors.

Waller Loan Fund—Bequest of Helen S. Waller received in 1973, to be loaned to deserving and needy students.

Janice and George Wasserman Medical Student Loan Fund—Created in 1978 by the George Wasserman Foundation, Inc., to be loaned to deserving and needy students.

Wrather Loan Fund—Created in 1967 by gift of Mrs. W.E. Wrather in memory of her husband, to be loaned to students.

In addition, financial assistance is available through the—

Catherine Breen Student Loan Fund (1972)—Established by alumni of the School of Medicine and Health Sciences in honor of Catherine Breen, former Assistant to the Dean of the Medical Center. Available to needy students who are candidates for the degree of Doctor of Medicine. Applications should be made to The George Washington University Medical Alumni Association.

Health Professions Student Loan Program—This fund is available to a full-time student pursuing a course of study leading to the degree of Doctor of Medicine. Interns, residents, students engaged in premedical or other professional training, and students enrolled in programs of study other than those leading to the degree mentioned above are *not* eligible for these loans.

A candidate must (1) be a citizen of the United States or have such immigration status and personal plans as to indicate an intention to become a permanent resident of the United States, (2) be in "exceptional financial need"

according to federal regulations, and (3) be in good standing with the School. Inquiries concerning deadlines and applications should be directed to the Financial Aid Office of the School of Medicine.

National Direct Student Loan Program—This fund is available for full-time students in good standing with the school in which they are enrolled. Students must be citizens or permanent residents of the United States. All loans from the program are made on the basis of financial need. Applications for medical students are distributed by the Financial Aid Office.

Jessie B. Martin Loan Fund (1967)—Established by friends of Jessie B. Martin, former Editor of Academic Publications at the University. An emergency fund for loans up to $200, repayable in 30-60 days, with interest rate of 3 per cent per annum. Application should be made to the Director of the Office of Student Financial Aid of the University.

PRIZES

Janet M. Glasgow Award of Outstanding Achievement, American Medical Women's Association, Inc.—Awarded annually if the student standing first in the graduating class is a woman.

American Medical Women's Association, Inc. Scholarship Achievement Citation—Awarded annually to those female students who are considered "honor graduates" when ranked against all other students in the graduating class.

Samuel M. and Miriam S. Dodek Prize (1967)—Established in memory of Professor Bernhard Zondek, the eminent discoverer of the endocrinology of the human female reproductive cycle. Awarded annually to a member of the graduating class who has attained a commendable knowledge and understanding of the field of female endocrinology.

Allie S. Freed Prize (1957)—Awarded annually to a member of the graduating class who has demonstrated exceptional proficiency in the field of preventive medicine.

Walter Freeman Prize (1966)—Awarded annually to a student in the graduating class who submits the best essay based on original investigation.

Alec Horwitz Prize (1959)—Awarded annually to a senior who has demonstrated exceptional proficiency in the field of surgery.

Oscar Benwood Hunter Prize (1952)—Established by The George Washington University Medical Society, now known as The George Washington University Medical Alumni Association. Awarded annually to a member of the graduating class who has demonstrated outstanding ability in pathology.

Jacobi Medical Society Prize (1962)—Established in memory of Dr. Abraham Jacobi, the founder of pediatrics practice in the United States. Awarded annually to a member of the graduating class who has demonstrated outstanding ability in pediatrics.

Howard Kane-A.F.A. King Obstetrical Society Prize (1937)—Established in memory of Dr. Howard Kane and Dr. A.F.A. King, who served as Professors in the School of Medicine and Health Sciences. Awarded annually to a member of the graduating class who has demonstrated outstanding ability in obstetrics and gynecology.

Dr. Harold Lamport Biomedical Research Prize—Established by the Lamport Foundation in memory of the late, distinguished physiologist, Dr. Harold

Lamport. Awarded annually to the student writing the best paper on original laboratory investigation in physiology.

Lange Medical Publications Prize—Awarded annually to two members of the graduating class who are considered outstanding. The prize consists of the graduate's choice of four books published by Lange Medical Publications.

Huran W. Lawson Prize (1957)—Established by Mrs. Lawson in memory of her husband, who was a distinguished member of the Medical Staff of the University. Presented annually to a member of the graduating class who has demonstrated exceptional proficiency in the field of obstetrics and gynecology.

Benjamin Manchester Prize (1966)—Established by a grateful patient in honor of Dr. Benjamin Manchester, clinical professor of medicine. Awarded annually to a member of the graduating class who has an outstanding record and shows promise of real humanitarianism in the practice of medicine.

C.V. Mosby Book Prize—Awarded annually to five members of the graduating class who are considered outstanding by their classmates. The prize consists of the graduate's choice of a book published by C.V. Mosby Company.

Julius S. Neviaser Prize in Orthopaedic Surgery (1956)—Awarded annually to the senior who scores the highest grade in a written examination and clinical aspects of orthopaedic surgery.

John Ordronaux Prize (1907)—By bequest, awarded annually to the member of the graduating class who has the highest scholastic standing.

Walter F. Rosenberg Prize (1980)—Awarded to the senior medical student who shows the greatest interest, proficiency, and scholastic achievement in dermatology.

William G. Schafhirt Prize (1966)—By bequest, awarded annually to a senior student for the best original essay or thesis on some medical subject of current public interest.

Upjohn Achievement Prize—A prize and an inscribed plaque awarded annually to a member of the graduating class selected by his or her classmates on the basis of outstanding scholastic and personal achievement.

HONOR SOCIETIES

Alpha Omega Alpha—National Honor Medical Society. Third- and fourth-year candidates for the M.D. degree meeting the qualifications specified by the constitution of the Society are eligible for election to membership.

William Beaumont Medical Society—Medical students who have performed original research in the life sciences are eligible for membership, based upon the submission of an acceptable abstract of the research and election by society members. Outstanding students present their research findings at the annual Student Research Day. The Society also sponsors guest lectures in medical research and assists students in finding research opportunities within the Medical Center.

Howard Kane-A.F.A. King Obstetrical Society—The 15 third- and fourth-year candidates for the M.D. degree who maintain the highest grades in their work in obstetrics are eligible for membership.

CENTER FOR AGING STUDIES AND SERVICES

The Center offers opportunities for learning through a multi-disciplinary, comprehensive, gerontology/geriatrics program. The program encompasses edu-

cation, training, research, and direct service activities in the field of aging throughout the University. The Center for Aging Studies and Services is based in the Department of Health Care Sciences. Its major components in the Medical Center are the programs in Geriatric Medicine and in Gerontology and the Adult and Geriatric Nurse Practitioner Program.

Geriatric Medicine Programs

The geriatric service provides primary care to patients over age 65 in outpatient clinics, specialty clinics, and the emergency room in the Medical Center. Rounds take place daily in the University Hospital and several area nursing homes. In the outpatient geriatric clinics, comprehensive assessment and follow-up of patients' physical and mental health, social and economic status, and ability to carry out the tasks of daily living is coordinated and conducted by a geriatric team consisting of a geriatrician, a primary care resident, a social worker, and a physician assistant or nurse practitioner. Students may develop an area of concentration in geriatrics/gerontology through the Center for Aging Studies and Services.

Geriatric content is included in the second-year basic curriculum and in the required Issues in Health Care course (HCS 369). The required primary care clerkship for third-year students includes a rotation on the geriatric service, and electives in clinical geriatrics are available for first-, second-, and fourth-year students.

Program Activities in Gerontology

Gerontology activities within the Center for Aging Studies and Services are made possible through formal and informal linkages with community-based agencies that serve the elderly and with other schools within the University. Both arrangements provide opportunities for students in the Medical Center to expand their knowledge about older persons and develop skills in direct work with the elderly.

Medical students and health practitioner students are encouraged to take part in ongoing service projects or help create new ones through the Community Outreach Program for the Elderly. The field experiences made possible through this program provide students with opportunities to learn through direct service activities in the home and in community-based sites. Service learning activities include needs assessment interviews in the home to identify need for services and follow-up; monitoring and advocacy activities to link elderly persons with needed services that will prevent untimely and inappropriate institutionalization; health talks at senior centers to inform elderly persons about how to care for themselves; work with older persons in community-based services agencies to develop and implement interdisciplinary health, education, and physical fitness programs; and participation in seminars designed to augment field experiences.

In addition to the outreach programs that provide experimental learning in aging, courses with specific focus on aging, offered by several schools in the University, provide additional opportunities for developing special knowledge in the field of aging.

A Master of Arts in Special Studies with a concentration in gerontology is available through the Graduate School of Arts and Sciences. In addition to

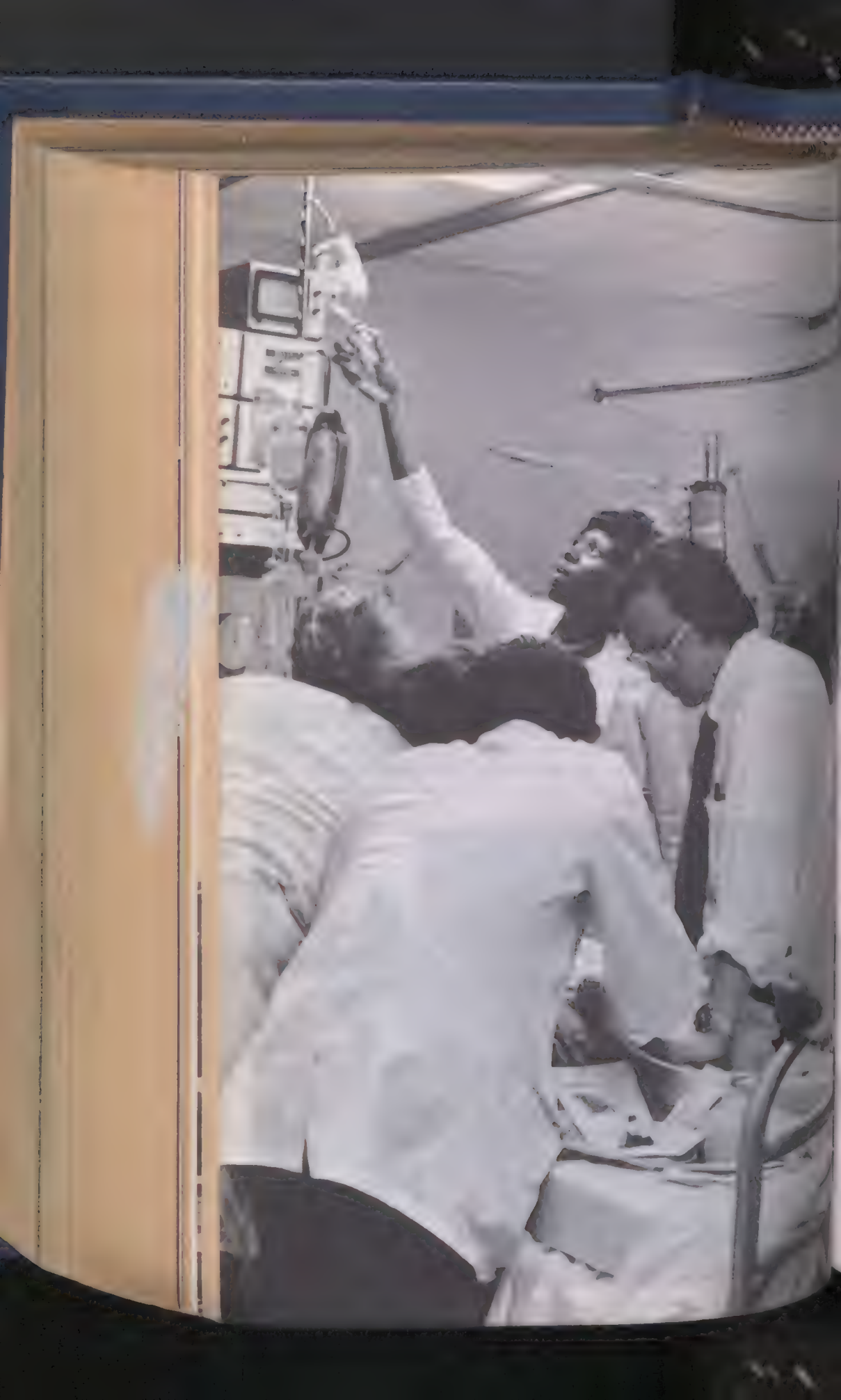
the courses under Health Care Sciences (HCS 193, 194) and under Psychiatry and Behavioral Sciences (Pchi 417), the following are examples of courses in aging offered by other University departments:

Educ 344	Adult Development and Aging
Educ 353	Counseling Older Persons
Educ 383	Interviewing-Counseling for Human Resource Developers
Gern 201	The Biology of Aging
Gern 205	Public Policy and Aging
Gern 290	Practicum in Gerontology
HSA 235	Human Services Integration
HSA 236	Introduction to Long-Term Care Administration
HSA 237	Managing the Long-Term Care Institution
HSA 255	Issues in Gerontology
Psyc 188	Attitudes Toward Death and Dying
SLP 158	Society and Aging
Soc 151–52	Problems of Urban Social Systems
Soc 160	Death and Dying: A Sociological Perspective
Soc 181	Major Social Processes
Soc 254	Seminar: Methods in Social Policy Research
Soc 280	The Sociology of Aging

Adult/Geriatric Nurse Practitioner Program

The Nurse Practitioner Program prepares registered nurses to practice mainly in primary care settings of long-term care facilities. The program consists of two semesters of course work and one semester of clinical experience. For fuller detail on the curriculum of this program see the description under Allied Health Programs.





UNDERGRADUATE PROGRAMS IN ALLIED HEALTH

Programs of study in allied health at the School of Medicine and Health Sciences include those disciplines and skills that are allied to medicine in the delivery of health care and health education. The faculty of the School recognizes that modern medical practice requires increasing numbers of nonphysician health care professionals; that such allied health personnel are appropriately educated in an academic health center; and that new roles for health care practitioners require the introduction of new curricula in allied health education.

Current allied health course offerings at the School of Medicine and Health Sciences lead to the degrees of (1) Associate in Science, with a major in one of the following programs: Medical Laboratory Technique,* Nuclear Medicine Technology, and Radiologic Technology;* (2) Bachelor of Science in Health Science;* and (3) Bachelor of Science, with a major in one of the following programs: Medical Technology, Nurse Practitioner, Nursing Anesthesia, Physician Assistant, and Radiologic Sciences and Administration.

Certificates are also awarded to students upon successful completion of all of the requirements in one of the following programs: Medical Technology, Nuclear Medicine Technology (on-campus students only), Nurse Practitioner, Nursing Anesthesia, or Physician Assistant.

ADMISSION

The University reserves the right to refuse admission to any student whose academic record suggests an inability to succeed in college, or who, for any other reason, would not be acceptable as a student. In the selection process, no discrimination is made on the basis of sex, race, color, religion, age, or national or regional origin.

An application for admission to degree candidacy in any of the allied health programs must be accompanied by a nonrefundable $20.00 fee,† payable by check or money order to The George Washington University. The application fee is waived for students applying for readmission who were enrolled as degree candidates at the time of their last registration at this University and who have not since registered at any other institution.

Application forms are available upon request from the program to which a student seeks admission.‡ Applicants should refer to the individual program

* For off-campus military students only.

† Except for G.W.U. Medical Technology students who are applying to the clinical (fourth) year of the program and off-campus military students.

‡ Except for the first three years of the Medical Technology program. Such applicants should request forms from the Office of Admissions, The George Washington University, 2121 Eye Street, N.W., Washington, D.C. 20052.

descriptions for the appropriate mailing address and for information on additional prerequisites, supportive documents, and application deadlines, since these vary from program to program. Application forms for *readmission* are available from the Office of Allied Health Administration, The George Washington University School of Medicine and Health Sciences, 2300 Eye Street, N.W., Washington, D.C. 20037. Completed applications, whether for admission or readmission,* must be returned to the Office of Admissions, The George Washington University, 2121 Eye Street, N.W., Washington, D.C. 20052.

Admission to Degree Candidacy

The general requirements for admission to allied health degree programs are as follows:

1. Graduates of secondary schools must have a diploma based on an acceptable academic record from an accredited secondary school. Applicants who have not graduated from secondary school must show evidence of satisfactory scores on the General Educational Development (GED) High School Level tests.

2. Students who have completed secondary school within two years of the date of their application for degree candidacy and who have not attended any college or university must submit evidence of acceptable scores on the Scholastic Aptitude Test (SAT)† of the College Entrance Examination Board (CEEB); applicants without previous college credit who have completed secondary school more than two years before their date of application will be asked to take other tests during the application process.‡

3. Students who have completed fewer than 12 semester hours of acceptable course work at an accredited college or university before applying for degree candidacy must submit evidence of a satisfactory secondary school record and of acceptable scores on one of the following tests: SAT, ACT, or College-Level Examination Program (CLEP).

4. Students who have already completed 12 or more semester hours of acceptable course work at an accredited college or university must demonstrate that they have maintained a cumulative quality-point index of 2.0 in course work; they must be in good standing as to scholarship and conduct and be eligible to return to the academic institution most recently attended in the same semester for which admission is sought at The George Washington University. A student who has been academically dismissed or suspended more than twice is ineligible for consideration for at least five years from the date of the last suspension or dismissal.

REQUIRED CREDENTIALS

In addition to the general list of required credentials that follows, applicants should refer to the individual program descriptions for information on additional requirements:

1. If applicable, a transcript of secondary school work or, for students who are not graduates of secondary schools, GED scores. Official transcripts must

* Except for off-campus military students, who should return their forms for readmission to the Office of Allied Health Administration.

† The SAT is preferred; the American College Testing (ACT) battery scores may, however, be substituted.

‡ Except for off-campus military students.

be forwarded directly from the institution attended to the Office of Admissions. A transcript submitted by the student is not acceptable.

2. For applicants who have attended any college, university, or other institution of higher learning, an official transcript forwarded to the Office of Admissions from the Office of the Registrar at each institution attended, regardless of whether credit was earned or desired.

3. Scores on standardized examinations (SAT, ACT, CLEP, etc.), if required, forwarded by the administering agency directly to the Office of Admissions.

4. Service school records, where applicable.

ADVANCE TUITION DEPOSIT

Upon notification of acceptance, a $100 tuition deposit will be required of all full-time, on-campus undergraduate students. The deposit is credited toward tuition and is not refundable.

Admission as an Unclassified Student

A student who wishes to take individual courses in allied health programs without applying for degree candidacy must apply for admission to the University as an unclassified undergraduate student in the School of Medicine and Health Sciences. The Director of Allied Health Administration, in conjunction with the appropriate program director and the chairman of the department offering the course, shall determine whether admission will be granted to unclassified students. Credits earned as an unclassified student may be transferred to degree programs at the University provided the course(s) are applicable to the desired curriculum, the student meets the requirements of the degree program for which application is made, and is admitted. Permission to take individual courses, if granted, will be limited to six semester hours per student.

Advanced Standing

Advanced standing may be awarded toward the associate and baccalaureate degrees for appropriate course work completed previously at other academic institutions with a minimum grade of *C*. Advanced standing may also be awarded for nontraditional classroom of clinical experience. Students are reminded, however, that they must complete the required course work in their major at this University, no matter how much advanced standing is granted. Students must also satisfy the residence requirement for their degree programs (see pages 62, 65).

It is the student's responsibility to request that certified, official transcripts of all course work taken at other institutions and the results of examinations be sent by the issuing institution or agency directly to the Office of Admissions, The George Washington University, 2121 Eye Street, Washington, D.C. 20052. If the applicant has fewer than 12 semester hours of acceptable transfer credit (grades of *C* or better on academic work from an accredited institution) at the time the application is submitted, the applicant's secondary school record must also be sent directly from the school to the Office of Admissions.

The University reserves the right to refuse credit for transfer in part or in whole. No time limitation will be placed on the transfer of credits from other

institutions, with the exception of the area of vocational competence; voca-
tional competence credit will not be granted for work completed five of mor
years prior to application unless proficiency and/or continued maintenance
skills can be demonstrated.*

Degree candidates who are currently enrolled at this institution must obtai
permission from the Office of Allied Health Administration before registerin
to take examinations, correspondence courses, or courses at other accredite
institutions.

CREDIT FROM INSTITUTIONS OF HIGHER LEARNING

Allied health degree programs vary in the amount of advanced standing the
will award for course work previously completed. Students may obtain furthe
information from the Office of Allied Health Administration.

CREDIT FOR NONTRADITIONAL CLASSROOM OR CLINICAL EXPERIENCE

The amount and types of advanced standing credit vary from program to
program. Again, students should check with the Office of Allied Health Admi
istration for further information. Credit may be awarded on the basis of non
traditional classroom or clinical experience, by a combination of any of the
methods described below:

Credit from Service Schools—A limited amount of credit may be assigned
for selected service school instruction. Current military students must submit
a DD Form 295; copies of service school records are not acceptable. Veterans
should submit photostatic copies of their discharge papers. Additional credits
may be required.

Special Departmental Examinations—A student may, on occasion, be per-
mitted to petition any department to take a special examination covering the
subject matter of a specific course. Approval of such a request is not auto-
matically granted; the student must offer evidence of sufficient occupational
or educational background to indicate a reasonable command of the subject
matter. A student who has previously taken examinations to waive course re-
quirements may not subsequently take examinations for credit in the same
courses. Assigning credit (or waiving a requirement) by special departmental
examination will depend on the department's evaluation of the examination
paper. These examinations will normally be of at least three hours' duration.
A fee of $25 for each course examination is charged for preparation, ad-
ministration, and grading of the examination.

*Credit for College Entrance Examination Board College-Level Examination
Program (CLEP)*—CLEP offers two types of examinations: General and Sub-
ject Examinations. CLEP General Examinations are offered in five areas:
mathematics, social sciences, humanities, natural sciences, and English compo-
sition. CLEP Subject Examinations measure achievement of specific college-
level courses and are offered in more than 20 subjects.

Upon admission to degree candidacy, credit is assigned for the General
Examinations passed at the 50th percentile or above (college sophomore
norms).† Credit is usually assigned for the Subject Examinations passed at the

* Except for off-campus military students.

† The George Washington University will not assign credit for the CLEP General Examinations e
the areas of English composition and mathematics; these may be taken as Subject Examinations only

level recommended in the College Board model policy. Credit may not be earned by passing the examination after taking an equivalent course. Arrangements for taking the examinations are solely the responsibility of the applicant and should be made through the College Entrance Examination Board College-Level Examination Program, Box 592, Princeton, N.J. 08540.

Credit for New York State Board of Regents Examination—Applicants for degrees who present proper certification of award of a degree at the Associate's level from the New York State Board of Regents may be awarded a maximum of 60 semester hours of advanced standing.

Credit for Correspondence Courses—Advanced standing may be awarded through the successful completion of appropriate correspondence courses offered by accredited colleges and universities.*

Readmission

Students previously registered in the University who were not registered during the immediately preceding semester (summer sessions excluded) must apply for readmission. Students who were previously registered as unclassified, or who attended one of more institutions of higher learning during their absence from this University and now wish to apply for readmission to their degree program, must have complete, *official* transcripts sent directly to the Office of Admissions at this University from each institution attended.† Applicants for readmission are evaluated on the basis of regulations currently in effect.

The application fee is waived for students applying for readmission who were registered as degree candidates at the time of the last registration at this University and who have not registered at another institution in the interim period.

Students from Foreign Institutions

Applications, required records, and scores on the *Test of English as a Foreign Language* (TOEFL) should all be received from international students no later than March 1.

REQUIRED RECORDS

Applicants must request all educational institutions attended to send official credentials listing subjects studied, grades received, examinations taken, and degrees received directly to the Office of Admissions, The George Washington University, 2121 Eye Street, N.W., Washington, D.C. 20052. Certified copies of diplomas and certificates from secondary schools and all colleges and universities attended are required. Records of state examinations and certificates are also needed. All records become the property of the University and cannot be returned.

These documents should be in the language in which the institution maintains its official records. If they are in a language other than English, the copies which are sent should be accompanied by an English translation.

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* Not awarded for on-campus programs.

† Off-campus military students who have attended additional service schools must also submit an updated DD Form 295.

LANGUAGE TESTS

Students whose native tongue is not English are required to take the *Test of English as a Foreign Language* (TOEFL) and have the scores submitted to the Office of Admissions. Students are responsible for making arrangements to take the test and should address inquiries to TOEFL, Educational Testing Service, Princeton, N.J. 08540, U.S.A., well in advance of the beginning of the semester for which admission is sought. The test fee remitted with the application entitles the student to have the test score sent to three different institutions. Registration for the *Test of English as a Foreign Language* does not constitute application for admission to The George Washington University.

The *Bulletin of Information*, obtainable without charge, contains a description of the test as well as rules regarding application, fees, reports, and the conduct of the test; lists of examination centers; examination dates; and an application blank. On the application for the test, the student should specify that the scores be sent to the Office of Admissions, The George Washington University, Washington, D.C. 20052.

In addition to the TOEFL, the Office of Admissions may require an admitted student to take an English Placement Test for foreign students prior to registration. The results of this test will determine the courses for which the student will be permitted to register in the proposed program of study.

REGULATIONS FOR UNDERGRADUATE STUDENTS IN ALLIED HEALTH PROGRAMS

Attendance

A student may attend only those classes for which he or she is registered. Regular attendance is expected; a student may be dropped from any course for undue absence.

Scholarship Requirements

A student who fails to maintain the scholarship requirements of the School of Medicine and Health Sciences may be dismissed from the University.

GRADES

Grades are mailed to the student through the Office of the Registrar at the close of each semester. They are not given out by instructors.

The following grading system is used: *A*, Excellent; *B*, Good; *C*, Satisfactory; *D*, Low Pass; *F*, Fail; *I*, Incomplete; *IP*, In Progress; *W*, Authorized Withdrawal; *Z*, Unauthorized Withdrawal. Except for courses which specifically state that repetition for credit is permitted, a candidate for a degree at this University may not repeat for credit a course in which a grade of *D* or better was received, unless required to do so by the department concerned. A written statement to this effect must be submitted to the Registrar by the appropriate department chairman or program director through the Director of Allied Health Administration. Whenever a grade has not been assigned, the symbol *I* (Incomplete), the symbol *IP* (In Progress), the symbol *W* (Authorized Withdrawal), or the symbol *Z* (Unauthorized Withdrawal) will be recorded. The symbol *I* indicates that the instructor has received a satisfactory explanation for the

student's inability to complete the required work of the course in time to meet the University's deadline to submit grades, and that the instructor has been informed of and has approved such reasons before the stated deadline. The grade of *I* may be submitted only if the student's prior performance and class attendance in the course have been satisfactory. Any failure to complete the work of a course which is not satisfactorily explained to the instructor before the date when grades must be turned in will result in the student's receiving a grade of *F*. A grade of *I* automatically becomes a grade of *F* one calendar year after the date of the last class meeting in the semester for which the grade of *I* was assigned. The symbol *IP* is reserved for courses (e.g., clinical rotations) in which the final date extends beyond the official University deadline for submitting grades.

THE QUALITY-POINT INDEX

Scholarship is computed in terms of the quality-point index (QPI), obtained by dividing the number of quality points by the number of semester hours for which the student has registered, both based on the student's record in this University. Quality points are computed from grades as follows: *A*, four points; *B*, three points; *C*, two points; *D*, one point; *F*, no points, for each semester hour for which the student has registered. Courses in which the grades of *W*, *I*, or *IP* are assigned are not considered in determining the index, except that any course in which the grade of *I* or *IP* has been assigned will be included later, when a formal grade has been recorded. Grades earned at other institutions are not included in computing the QPI.

DEAN'S HONOR LIST

Students who achieve a QPI of 3.50 or higher in any one semester are placed on the Dean's Honor List for that semester. The list is limited to full-time students registered for a minimum of 12 semester hours and part-time students registered for a minimum of 12 semester hours over two consecutive semesters, which may include a summer term.

PROBATION

A student who has attempted a minimum of 12 semester hours of course work and whose cumulative QPI is below 2.00 will be placed on *academic* probation for the period in which he or she next attempts 12 additional semester hours of work. A student whose QPI in the core curriculum falls below 2.50 in any one semester will receive a warning letter and will not be permitted to graduate unless the QPI is successfully raised to the required minimum level. Students should refer to the individual program descriptions for further information on the core curriculum. A student whose attendance or conduct has been unsatisfactory may be placed on *disciplinary* probation for the period in which he or she next attempts 12 additional semester hours of work.

SUSPENSION

Any student whose cumulative QPI remains below 2.00 after a 12-semester-hour period of probation will be suspended.

A student suspended for poor scholarship may not register for course work even as an auditor. The student may apply for readmission after the lapse of either the fall or the spring semester following suspension. Evidence must then be presented to the Director of Allied Health Administration, through the appropriate program director, demonstrating that the student is now better prepared to pursue college-level course work. Any student suspended twice for poor scholarship will not be readmitted after the second suspension.

Withdrawal

Withdrawal from a course or from the University requires the approval of the student's advisor, the course instructor, and the Director of Allied Health Administration. Permission to withdraw from the University, however, will not be granted to a student who does not have a clear financial record (see "Withdrawals and Refunds," pages 59–60). The deadline for withdrawal from a course will fall exactly four weeks from the first day of registration, each semester.*

All charges for courses dropped without the approval of the Office of Allied Health must be met by the student. Reporting the dropping of a course to an instructor does not constitute an official withdrawal.

Changes in Program of Study

Changes Within the School of Medicine and Health Sciences' Allied Health Programs—Students may not substitute one course for another, drop courses (see "Withdrawal" above), or change their status from credit to audit or audit to credit without the approval of their advisor, the course instructor, and the Director of Allied Health Administration.

Transfer Within the University—Application for transfer to another college, school, or division must be made to the Office of Admissions. A maximum of 30 semester hours earned in the Division of University and Summer Students may be applied toward a baccalaureate degree in The School of Medicine and Health Sciences.

Credit

Credit is given only after registration for a course and satisfactory completion of the required work, or upon the assignment of advanced standing in accordance with the regulations of the several colleges, schools, and divisions.

Auditing

A student who has been admitted to any one of the allied health programs may register as an auditor in a class, with the permission of the instructor, as well as the approval of the faculty advisor and the Director of Allied Health Administration. An auditor receives no academic credit and is not required to take active part in the class or to pass examinations. A student who receives permission to audit a course may not repeat it later for credit. The on-campus tuition rate is applied to audited courses.

* Except for off-campus military students.

Balance Sheet

After a student has been admitted and registers in a particular program, the Office of Allied Health Administration will issue a balance sheet showing the amount of work completed and the requirements still to be met for the degree. A second balance sheet is issued only if the student changes major or degree objectives.

Transcripts of Record

The Office of the Registrar will issue official transcripts of student records upon the request of a student or former student who has a clear financial record. A fee of $2 is charged for each transcript. When more than two transcripts are ordered at the same time, a $2 fee is charged for each of the first two transcripts, and a $.50 fee is charged for each additional transcript.

Continuous Enrollment Procedures

Once entered in a degree program, a student is expected to be continuously enrolled and actively engaged in fulfilling the requirements for the degree each semester of the academic year until such time as the degree is conferred. Should the student break continuous enrollment at the University and not request and be granted a leave of absence (see below), or be assigned to inactive status (see below) by the Office of Allied Health Administration, he or she must apply for readmission and, if granted, be subject to the requirements and regulations then in force. A student who plans to attend another institution and apply credit so earned toward graduation from this University must first secure written approval from the Office of Allied Health Administration.

LEAVE OF ABSENCE

Should a student find it necessary to interrupt active pursuit of the degree, he or she must submit a petition, along with a Continuous Enrollment Form, to the program director and the Director of Allied Health Administration requesting a leave of absence for a specific period of time, generally limited to one calendar year. A degree student who discontinues active enrollment in degree studies without being granted a leave of absence, or a student granted a leave who does not return to active study at the close of the period of approved absence, must apply for readmission and be subject to the regulations and requirements then in effect. Students are assessed no fees while on leave of absence.

INACTIVE STATUS

A student may request permission to be placed on inactive status. A Continuous Enrollment Form for this purpose should be initiated by the student and approved by the program director and the Director of Allied Health Administration during the registration period for the semester involved.* Such permission, if approved, will maintain a student's enrollment at The George Washington University. Inactive status will also allow a student to take approved

* Off-campus military students will receive Continuous Enrollment Forms in the mail automatically, provided that they have maintained continuous enrollment at this University.

course work at another institution and have that credit applied toward his or her remaining degree requirements.

Graduation Requirements

Degrees are conferred in February, May, and September. Graduating allied health students may participate in the annual May commencement ceremony of the School of Medicine and Health Sciences.

To be recommended for graduation by the Faculty, a student must have met the admission requirements of the college or school in which he or she is registered; have completed satisfactorily the scholarship, curriculum, residence and other requirements for the degree for which he or she is registered; and be free from all indebtedness to the University. Registration, either for course work or for continuous enrollment, is required for the semester or summer session at the close of which the degree is to be conferred.

Application for Graduation—An Application for Graduation Form must be filed and the appropriate fee paid *at the time of registration for the last semester or summer session of the senior or final year.**

Scholarship—The student must meet the scholarship requirements for the particular degree for which he or she is registered.

Curriculum—Minimum curriculum requirements for each degree are stated on pages 60–62, 64, and 65.

Residence—Students must complete a minimum of 18 semester hours of course work in their major for the Associate in Science degree and a minimum of 30 semester hours of course work in their major for the Bachelor of Science degree while registered in the School of Medicine and Health Sciences. This requirement applies to students transferring within the University as well as to students transferring from other institutions.

Attendance and Conduct—The University reserves the right to refuse to confer a degree upon a candidate whose attendance or conduct has been unsatisfactory.

WITH DISTINCTION

Students in the allied health programs must have a QPI of 3.50 or higher in all course work taken at this institution to be eligible for a baccalaureate degree conferred with distinction. Students must also have completed at least one-half of the courses required for the degree at this institution.

Certificate Requirements

Certificates will be awarded to those students who successfully complete all the requirements in one of the following programs: Medical Technology, Nuclear Medicine Technology,† Nurse Practitioner, Nurse Anesthesia, or Physician Assistant. In addition to completing all the stated requirements for the certificate, students must also be free from all financial indebtedness to the University.

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* Except for off-campus military students, who pay when they have completed their degree requirements.

† On-campus students only.

FEES AND FINANCIAL REGULATIONS FOR UNDERGRADUATE STUDENTS IN ALLIED HEALTH PROGRAMS

Fees paid by students cover only a portion of the cost of the operation of the University. Income from endowment funds, grants, and gifts from alumni and friends of the institution make up the difference.

The following fees and financial regulations were adopted for the 1982 summer sessions and the academic year 1982–83.

Tuition Fees

*Full-time on-campus program (12 or more semester hours), each semester	$2,450.00
Part-time on-campus program, for each semester hour	180.00
Summer Sessions, for each semester hour	160.00

University Center Fee (charged all students registered on campus)

For students registered for 11 or more semester hours on campus: Each semester	60.60
For students registered for less than 11 semester hours on campus: For each semester hour for which the student registers	5.75

Additional Course Fees

In certain courses offered by Columbian College of Arts and Sciences, additional fees, such as laboratory and material fees, are charged as indicated in the course descriptions in the *Undergraduate and Graduate Bulletin*. These fees are charged by the semester and, unless otherwise indicated, may be defrayed in two payments when the tuition is paid in this manner. If breakage of apparatus is in excess of the normal amount provided for in the laboratory fee, the individual student will be required to pay such additional charges as are determined by the department concerned.

Graduation Fees

Associate in Science	$10.00
Bachelor of Science	25.00

Residence Hall Fees (see pages 15–16)

Special Fees and Deposits

Application fee (nonrefundable)	$20.00
Advanced tuition deposit, nonrefundable, charged each entering or readmitted full-time undergraduate student	100.00
Housing deposit, nonrefundable, charged each applicant for residence hall space	200.00
Admission tests (when required)	6.00–12.00
Late-registration fee, for failure to register within the designated period	15.00
Late-payment fee (see "Payment of Fees," below)	15.00
Financial reinstatement fee, for reinstatement after financial encumbrance for non-payment of fees (see "Payment of Fees," below)	35.00
Returned check fee, charged a student whose check is improperly drafted, incomplete, or returned by the bank for any reason	15.00

* The annual tuition for the Nurse Practitioner and Physician Assistant Programs is $7,350.00, payable in three equal installments on or before registration for each semester. The Summer Sessions portion of the programs is considered a full regular semester.

Special departmental examination fee, to qualify for receiving credit (advanced standing), waiver of requirement, or both 25.00
Waiver examination to qualify for advanced placement 5.00
English test for foreign students (when required) 5.00
Laboratory checkout fee, for failure to check out of chemistry laboratory by the deadline set by the instructor* 10.00
Transcript fee 2.00
If two or more transcripts are requested at the same time, fee for the first two copies is $2 each, fee for each additional copy ..... .50
Replacement of lost or stolen picture identification card 2.00

Registration for on-campus courses in the University entitles each student to the following privileges: (1) the services of the Student and Alumni Career Services Office; (2) the use of the University Library; (3) gymnasium privileges; (4) admission to all athletic contests, unless otherwise specified; (5) subscription to the *University Hatchet*, the student newspaper; (6) admission to University debates; (7) medical attention as described under Student Health Service. These privileges terminate when the student withdraws or is dismissed from the University.

Payment of Fees

No student is permitted to complete registration until all charges are paid or until arrangements for payment have been made. Tuition and fees for each semester are due and payable in full at the Office of the Cashier at the time of each registration. Checks should be made payable to George Washington University, with the student identification number in the upper left-hand corner.

The Student Accounts Office has responsibility for billing and maintaining student accounts for tuition, various fees, and room and board charges. A student registered for six semester hours or more may sign a deferred payment contract with the Student Accounts Office at the time of each registration permitting payment of one-half of the total tuition and fees (except for fees payable in advance) at the time of registration, and the remaining half on or before Wednesday of the eighth week of classes for the fall and spring semesters. No deferred payment is permitted for the summer sessions, with the exception of full-time students in the Nurse Practitioner and Physician Assistant Programs. Interest at the rate of eight per cent per annum on the unpaid balance will be charged from the date of registration to the date payment is made. A 10-month payment plan is also available. Please note that students will not be eligible to receive their certificate in any program until the Office of Allied Health Administration receives notification of clearance from the Student Accounts Office.

Students receiving tuition assistance in the form of scholarships, government tuition contracts, or other forms of tuition awards are not permitted to sign deferred payment contracts unless the total tuition and fee charges exceed the value of the tuition awards by $800.00 or more. Under such circumstances the student may be permitted to pay one-half of the amount due from the student at the time of registration and to defer the balance by signing a deferred payment contract.

Students who fail to make any payment when due will be automatically charged a $15 late-payment fee and will be subject to an interest charge of eight

* A student who drops a chemistry course before the end of the semester must check out of the laboratory at the next laboratory period.

per cent per annum. Accounts which become 30 days past due will be financially encumbered. In the event a student's account is financially encumbered, the student forfeits rights to the use of deferred payment contracts in future semesters, and the Student Accounts Office will notify the Registrar to withhold grades, future registration privileges, transcripts, diplomas, and other academic information until the account is settled. Financial settlement will require payment in full of all amounts due the University in addition to a financial reinstatement fee of $35.

Returned Checks—A student whose check is returned unpaid by the bank for any reason will be charged a returned check fee. If the check is not paid within 15 days, the student will forfeit all rights to check cashing at the University, and future payments for tuition, dormitory, food service, and other special fees will require payment by cash, certified check, or money order.

Prepaid and Deferred Payment Plans

Several commercial programs for those who wish to pay for college on a monthly basis are available. Terms and conditions vary, but most provide a life insurance policy in the contract. For specific details and applications, address inquiries to the following:

1. Girard Edu-Check Plan, 2nd and Chestnut Streets, Philadelphia, Pa. 19106
2. Richard C. Knight Insured Tuition Payment Plan, 6 St. James Avenue, Boston, Mass. 02100
3. The Tuition Plan, Inc., Concord, N.H. 03301

The University's Office of Student Financial Aid does not maintain a supply of applications for these various programs but will be happy to provide guidance to students and parents.

Withdrawals and Refunds

Applications for withdrawal from the University or for change in class schedule must be made in writing to the Director of Allied Health Administration. Notification to an instructor is not an acceptable notice (see "Withdrawal," page 54).

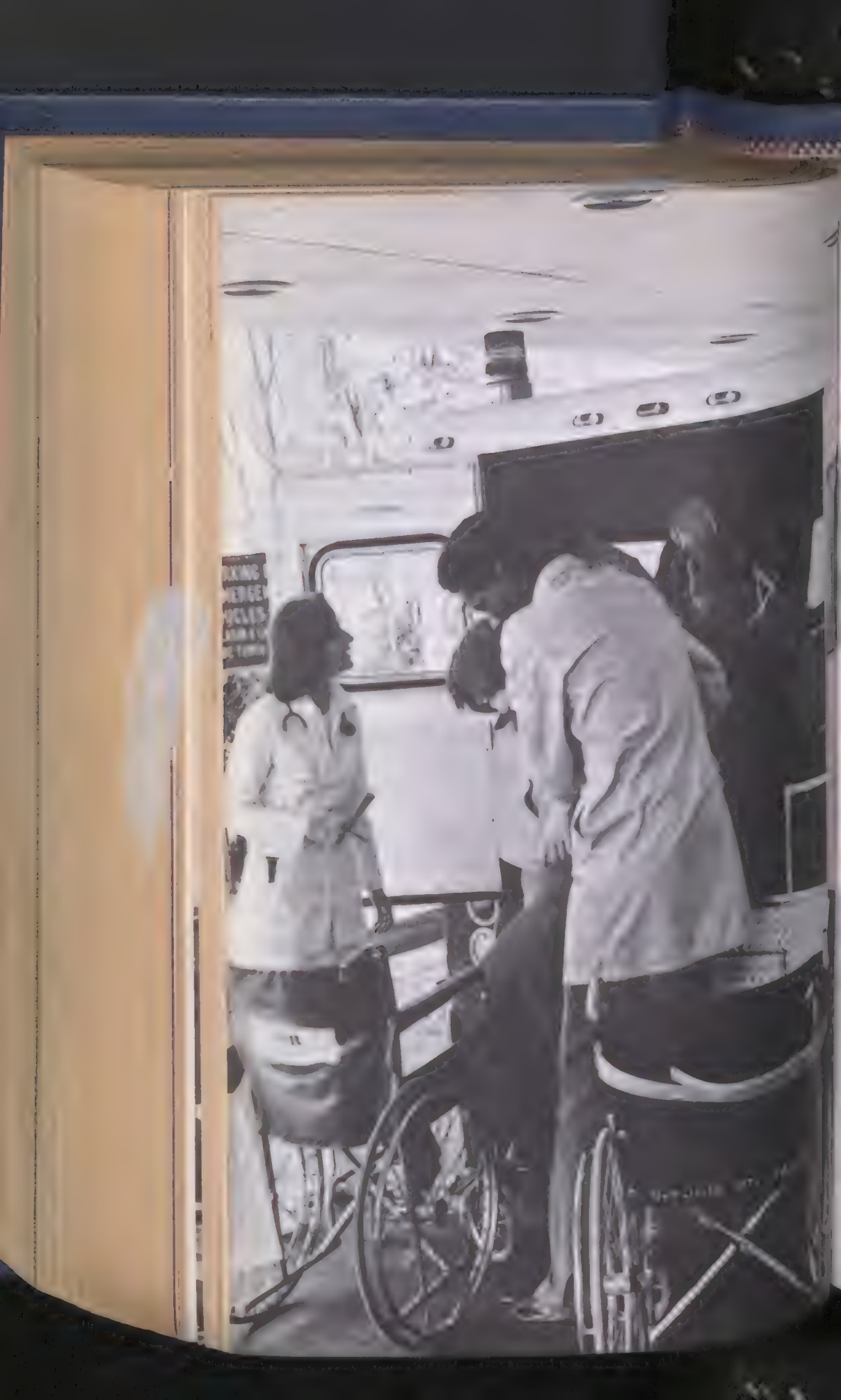
In authorized withdrawals and changes in schedule, cancellations of semester tuition charges and fees will be made in accordance with the following schedule for the fall and spring semesters:

1. *Complete withdrawal from the University:**

   Withdrawal dated on or before Saturday of the first week of classes 90%
   Withdrawal dated on or before Saturday of the third week of classes 75%
   Withdrawal dated on or before Saturday of the fifth week of classes 50%
   Withdrawal dated after the fifth week of classes .....none

2. For a *change in status from full-time to part-time student* or for *partial withdrawal by a part-time student*, the above schedule applies to the difference between charges for the original program and the adjusted charges for the revised program.

* Regulations concerning withdrawal and refunds for the summer sessions are stated in the *Summer Sessions Schedule of Classes*.



3. A student enrolled in an undergraduate full-time program who drops or adds a course and continues to be in a full-time program will have no financial adjustments of tuition made other than those involving course fees.
4. Regulations governing student withdrawals as they relate to residence hall and food service charges are contained in the specific lease arrangements.

Refund policies of the University are in conformity with guidelines for refunds as adopted by the American Council on Education.

In no case will tuition be reduced or refunded because of absence from classes.

Authorization to withdraw and certification for work done will not be given a student who does not have a clear financial record.

Students are encouraged to provide their own cash funds until they can make banking arrangements in the community.

FINANCIAL AID

For full-time undergraduate students, George Washington University has a program of financial assistance consisting of scholarships, loans, grants, part-time employment, or any combination of these resources. The University participates in the National Direct Student Loan, Supplemental Educational Opportunity Grant, and College Work-Study programs. Financial aid is awarded on the basis of the student's scholastic record, financial need, and qualities of leadership. Complete information concerning financial assistance is available from the Office of Student Financial Aid, George Washington University, Washington, D.C. 20052. **Students intending to apply for financial aid should do so at the time they return the completed application form, since all applications for financial aid *must be filed by March 1*, regardless of whether the student has been admitted by that date.**

REQUIREMENTS FOR THE DEGREE OF ASSOCIATE IN SCIENCE

The satisfactory completion of a minimum of 60 semester hours of course work is required for the degree of Associate in Science; some programs, however, may set the requirements above the minimum. The course work must be distributed as follows:

1. **Human Competence**

   A minimum of six semester hours in English Composition (Engl 9 or 10 and 11 or 12) or the equivalent, plus a minimum of six semester hours to be selected from a wide array of course offerings in the humanities, social sciences, or mathematics.*

* Mathematics electives vary according to the program. Students should check the individual program descriptions for further information.

3. **Core Curriculum (Required Courses)**

   The core curriculum is dictated by the specific requirements of the individual program. The number of semester hours varies slightly from program to program, but a minimum of 48 semester hours is required for an Associate in Science degree.

Students who plan to pursue a baccalaureate degree are advised to plan their associate's degree program so that, where possible, they will satisfy the prerequisites to the degree of their choice.

Scholarship Requirements

A minimum cumulative QPI of 2.00 is required for course work leading to the degree of Associate in Science. A minimum cumulative QPI of 2.50 is required for course work in the core curriculum. See pages 52–53 for explanation of the grading system and the QPI, and the individual program descriptions for information on the core curriculum.

Residence Requirement

A minimum of 18 semester hours of course work in the major must be satisfactorily completed in residence in the School of Medicine and Health Sciences.

MEDICAL LABORATORY TECHNIQUE PROGRAM

The program of study leading to the degree of Associate in Science with a major in medical laboratory technique is offered only to off-campus military students.

Admission to Degree Candidacy

General requirements for admission to degree candidacy are stated on pages 47–49. Students who do not meet these requirements may be considered for degree candidacy after the satisfactory completion of a probationary period of 15 semester hours of course work taken in residence at The George Washington University with a minimum QPI of 2.50.

Degree Requirements

The satisfactory completion of a minimum of 61 semester hours is required, the course work to be distributed as follows:

Human Competence—6 semester hours of Engl 9 or 10 and 11 or 12 (or the equivalent); 6 semester hours of college math or 3 semester hours of college math and a humanities or social science elective.

*Core Curriculum (Required Courses)**—Path 13, 14, 15a, 15b, 16, 17, 18, 19, 20; and Chem 9 (the latter is not included in computing the QPI).

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* This requirement is fulfilled by successful completion of Medical Laboratory Technique School (NEC 8506).

Scholarship Requirements

Students must maintain an overall QPI of 2.50 in the core curriculum courses.

NUCLEAR MEDICINE TECHNOLOGY PROGRAM

The program of study leading to the degree of Associate in Science with a major in nuclear medicine technology is offered to on-campus students and to off-campus military students.

Admission to Degree Candidacy

General requirements for admission to degree candidacy are stated on pages 47–49. Applicants must be at least 18 years of age by the time they first register as a student in the program. A personal interview and two letters of recommendation from previous instructors, advisors, or employers should accompany the application.* Students who do not meet the standard requirements may be considered for admission to degree candidacy after the satisfactory completion of a probationary period of 15 semester hours of course work taken in residence at The George Washington University with a minimum QPI of 2.50.

Degree Requirements

The satisfactory completion of at least 60 semester hours of course work is required. Anat 115 and HCS 111, or their equivalents, are prerequisite to all other courses in nuclear medicine technology.

Human Competence—6 semester hours of Engl 9 or 10 and 11 or 12 (or the equivalent); 3 semester hours of social science (general psychology is recommended); and 3 semester hours of humanities.

Core Curriculum (Required Courses)†—Rad 43, 44, 55, 56, 57, 58, 59, 65, 66, 72, 75, 81, 82, 93, 94, 98.

Scholarship Requirements

Students must maintain an overall QPI of 2.50 in the core curriculum courses.

Certificate

A certificate will be awarded to on-campus students who successfully complete the required courses in the Nuclear Medicine Technology program.

Applications

Application forms for on-campus students are available from the Radiologic Allied Health program, 2300 Eye Street, N.W., Washington, D.C. 20037, (202)676-3650. The deadline for the return of completed applications is March 1.

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* Except for off-campus military students.

† This requirement is fulfilled by successful completion of Nuclear Medicine Technology School (NEC 8416).

RADIOLOGIC TECHNOLOGY PROGRAM

The program of study leading to the degree of Associate in Science with a major in radiologic technology is offered only to off-campus military students.

Admission to Degree Candidacy

General requirements for admission to degree candidacy are stated on pages 47–49. Students who do not meet the standard requirements may be considered for admission to degree candidacy after the satisfactory completion of a probationary period of 15 semester hours of course work taken in residence at The George Washington University, with a minimum QPI of 2.50.

Degree Requirements

The satisfactory completion of 61 semester hours is required, the course work to be distributed as follows:

Human Competence—6 semester hours of Engl 9 or 10 and 11 or 12 (or the equivalent); 3 semester hours of social science; and 3 semester hours of humanities.

*Core Curriculum (Required Courses)**—Rad 40, 41, 42, 50, 51, 60, 61, 62, 70, 71, 80, 90, 95, 96, 97, 99.

Scholarship Requirements

Students must maintain an overall QPI of 2.50 in the core curriculum courses.

REQUIREMENTS FOR THE DEGREE OF BACHELOR OF SCIENCE IN HEALTH SCIENCE

The Bachelor of Science degree program in Health Science is currently offered only to Advanced Hospital Corps off-campus military students.

Degree Requirements

The satisfactory completion of a minimum of 120 semester hours is required for the degree of Bachelor of Science in Health Science, distributed as follows:

Human Competence—30 semester hours: 6 hours in English composition; 3 hours in psychology; 21 hours in the humanities and social sciences.

Subject Competence†—30 semester hours: HCS 10, 15, 16, 116, and 133 are required, plus an additional 16 semester hours of didactic information in the biological sciences, physical sciences, and mathematics.

Vocational Competence†—60 semester hours: HCS 22, 67, 68, 92, 93, 96, 102, 126a, 126b, and/or 126c, 175, 180.‡

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* This requirement is fulfilled by successful completion of Radiologic Technology School (NEC 8427 8425).

† This requirement is fulfilled by successful completion of Advanced Hospital Corps School (NEC

‡ A corresponding number of credits for approved course work in a directly applicable allied health field may be substituted for HCS 175 and 180.

REQUIREMENTS FOR THE DEGREE OF BACHELOR OF SCIENCE

The satisfactory completion of a minimum of 120 semester hours of course work is required for the Bachelor of Science degree; some programs, however, may set the requirements above the minimum. The course work must be distributed as follows:

1. **Human Competence**

   A minimum of six semester hours in English composition (Engl 9 or 10, and 11 or 12 or equivalent) and 24 semester hours to be selected from the following three general areas: humanities, social sciences, and mathematics (algebra, geometry, trigonometry, and calculus only).*

2. **Subject Competence**

   A variable number of semester hours of didactic courses related to allied health sciences (see individual program descriptions). This requirement may include the biological, physical, and natural sciences (or mathematics, for off-campus military students only).

3. **Vocational Competence**

   A variable number of semester hours in vocational competence skills related to the major (see individual program descriptions).

Scholarship Requirements

A minimum cumulative QPI of 2.00 is required for course work in programs leading to the Bachelor of Science degree. A minimum cumulative QPI of 2.50 is required for core curriculum courses. See pages 52–53 for explanation of the grading system and the QPI, and the individual program descriptions for information on the core curriculum.

Residence Requirement

A minimum of 30 semester hours of course work in the major must be satisfactorily completed in residence in the School of Medicine and Health Sciences.

MEDICAL TECHNOLOGY PROGRAM

The satisfactory completion of 120 semester hours of course work is required for the degree of Bachelor of Science with a major in medical technology.

Residence Requirement

A minimum of 60 semester hours must be spent in residence for the degree of Bachelor of Science with a major in medical technology, including the 12-month medical technology program at the University Hospital in the fourth year (Path 121, 122, 123, 124, 125, 126, 130, 131, 132, and 133).

* Off-campus military baccalaureate candidates may include mathematics in subject competence but not in human competence.

Curriculum

1. *First Three Years*

		Semester Hours
Engl:	Engl 9 or 10 and 11 or 12	6
Humanities:	Six semester hours selected from one of the following combinations: Art 31–32, 71–72; Clas 71, 72, 108, 113; Chin 163–64; Engl 51–52, 61–62, 71–72, 191–92; Fren 51–52, 60, 91–92; Ger 51–52, 103–4; Mus 3–4; Phil 50 and 71, 111, 112, 113, 131, 132, 151, 152, 162, or 172; Rel 9–10, 59–60, 21–22, or 23 and 9; Slav 71, 91–92; Span 51–52, 91–92; SpDr 45, 49, 133, 143, 144, 165, 166, 192	6
Math:	Math 30	3
Science:	BiSc 11–12, 111; Micr 129	13
	Four semester hours selected from BiSc 104, 127, 128, 145, 148, 155, 163, 164, 165	4
	Chem 11–12, 22, 50	14
Social Science:	Six semester hours selected from one of the following combinations: AmCv 71–72; Anth 1–2; Econ 1–2; Geog 1–2, Hist 71–72, 39–40, 72 and 91, 40 and 91; Jour 71–72, 111 and 115; PSc 1–2; Psyc 1 and 5, 6, 8, 22, or 29; Soc 1 and 2 or Soc 1 and any 100-level sociology course	6
		15
Electives:	Non-science electives	12
	Non-science or science electives	
		90

2. *Senior Year*—Path 121, 122, 123, 124, 125, 126, 130, 131, 132, 133.*

Admission to the first three years of the baccalaureate degree program with a major in medical technology does not guarantee acceptance into the senior (clinical) year conducted at the University Hospital; George Washington University students, however, are given preference. Each student who wishes to be considered for the senior (clinical) year must apply separately for admission. Academic achievement in the sciences, personal interviews, and letters of recommendation will be used to evaluate candidates for admission to the senior year of study. An overall QPI of 2.00 is required in order to be considered for acceptance into the senior year. Application forms for the first three years of the program are available from The George Washington University Office of Admissions. Applicants for the senior year of study must apply personally to the Director of the Medical Technology program, 2300 Eye Street, N.W., Washington, D.C. 20037, (202) 676-2945, no later than December 15.

Certificate

A certificate will be awarded to students who successfully complete the senior (clinical) year program in Medical Technology.

* All courses in the senior (clinical) year constitute the core curriculum. Students must maintain a minimum cumulative QPI of 2.50 in these courses in order to graduate.

NURSE PRACTITIONER PROGRAM

Admission to Degree Candidacy

The general requirements for admission to degree candidacy are stated on pages 47–49. Candidates for the degree of Bachelor of Science with a major in the Nurse Practitioner program must also meet the following prerequisites to be considered for admission:

1. Be a graduate of an accredited school of nursing with an overall QPI of at least 2.00 or the equivalent.
2. Be a licensed registered nurse in at least one state, U.S. trust territory, or the District of Columbia.
3. Have a minimum of two years' experience in nursing practice in hospital and/or ambulatory settings.

Applicants must submit three letters of recommendation of which at least one must be completed by a supervisor; the remainder may be submitted by present or former instructors or by colleagues who are familiar with the applicant's health-care-related experience.

Preference will be given to applicants who show evidence of having made arrangements to be employed as a nurse practitioner upon completion of the program.

Scholarship Requirements

General scholarship requirements are stated on page 65. Candidates for a Bachelor of Science degree with a major in the Nurse Practitioner program must maintain a cumulative QPI of 2.00 and a cumulative QPI of 2.50 in the core curriculum.

Advanced Standing

General provisions for advanced standing are listed on pages 49–51. In addition, students may receive up to 60 semester hours of advanced standing for successful completion of nursing school or courses in the physical, natural, or biological sciences which are applied toward subject competence. In addition, earned credits from other institutions may be applied toward human competence requirements. No advanced standing, however, will be granted for required courses in the major.

Residence Requirement

A minimum of 45 semester hours of course work in the major must be completed in residence in the School of Medicine and Health Sciences.

Degree Requirements

The satisfactory completion of a minimum of 120 semester hours is required for the degree of Bachelor of Science with a major in the Nurse Practitioner program. Course work is distributed as follows:

Human Competence—30 semester hours: 6 semester hours in English composition (Engl 9 or 10 and 11 or 12); 24 semester hours in the humanities, social sciences,

or mathematics (algebra, geometry, trigonometry, and calculus). HCS 109 and 1
may be included as social science electives.

Subject Competence—45 semester hours of course work in the biological, physic
natural, and nursing sciences.

*Vocational Competence**—45 semester hours as follows:

Clinical Health Sciences—HCS 125, 134, 137, 140, 142, 143, 144, 145, 147, 19
Anat 115; Micr 128; Path 129; Phyl 111.

Required Clinical Rotations—HCS 153, 154, 157.

Elective Clinical Rotations—Selected from the following: HCS 165, 170, 17
179, 180.

Certificate

A certificate will be awarded to students upon completion of the require
courses in the Nurse Practitioner program.

Applications

Application forms are available from the Nurse Practitioner Program, 122
25th Street, N.W., Washington, D.C. 20037, (202)676-4276. Completed ap
plications should be returned no later than March 30.

NURSING ANESTHESIA PROGRAM

Admission to Degree Candidacy

The general requirements for admission to degree candidacy are stated o
pages 47–49. In addition, candidates for the Bachelor of Science degree wit
a major in the Nursing Anesthesia program must fulfill the following pre
requisites to be considered for admission:

1. Complete successfully high school or college-level mathematics (genera
mathematics or algebra).
2. Complete successfully two semesters of college-level general chemistry
(General Chem I and II).
3. Be graduates of a state-approved school of nursing. Applicants must
also have completed a minimum of twelve months of practical experience
in critical-care nursing.
4. Be a licensed registered nurse in at least one state, U.S. trust territor
or the District of Columbia.
5. Satisfy the admissions requirements of the school of anesthesia at one
the affiliated hospitals prior to being admitted to the program at The
George Washington University.

Scholarship Requirements

Students must maintain a cumulative QPI of 2.50 in all nursing anesthesi
courses taken in the first two semesters. Any student who does not maintain
2.50 average may be required to take additional course work in order to ob
tain a minimum 2.50 average in the 30 hours of the core curriculum.

* All courses listed under vocational competence constitute the core curriculum.

Advanced Standing

The general provisions for awarding of advanced standing are stated on pages 49–51. In addition, the following specific criteria in the area of subject competence apply for the Bachelor of Science degree with a major in the Nursing Anesthesia program:

1. Students who are graduates of two- or three-year nursing school programs and who have had a minimum of twelve months of practical experience in critical-care nursing may receive up to 45 hours of advanced standing credit in Nursing.
2. Students who have earned a B.S. degree in Nursing may receive up to 60 hours of advanced standing credit in Nursing.
3. Certified Registered Nurse Anesthetists will receive credit in Nursing on an individual basis. Students seeking award of advanced standing credit on the basis of previous anesthesia work experience must demonstrate evidence of clinical competence.

Students who graduated from nursing school more than five years ago and have not been active in nursing during the last five years may be required to take National League of Nursing or New York State Board of Regents examinations.

Residence Requirement

A minimum of 30 semester hours of course work in the major must be completed in residence in the School of Medicine and Health Sciences.

Degree Requirements

The satisfactory completion of a minimum of 120 semester hours is required for the Bachelor of Science degree with a major in the Nursing Anesthesia program. Course work is distributed as follows:

Human Competence—30 semester hours: 6 semester hours in English composition (English 9 or 10 and 11 or 12); 3 semester hours in psychology; and 21 semester hours in the humanities, social sciences, or mathematics (algebra, geometry, trigonometry, and calculus).

Subject Competence—30 semester hours of course work in the biological, physical, natural, and nursing sciences.

Vocational Competence—60 semester hours as follows:

Year I: Phar 21, 22, 110, 111; Anes/Phar 191, 195; Anat 115; HCS 134; Phyl 111, Anes 198.

Year II: Anes 193, 194.

All students must complete Year I (that is, the core curriculum) in residence, with a minimum cumulative QPI of 2.50. Certified Registered Nurse Anesthetists may waive Year II of clinical course work on the basis of successful completion of Year I course work, demonstrated clinical competence, and satisfactory completion of an oral and/or written examination in the area of clinical anesthesia.

Certificates

A certificate will be awarded to students upon successful completion of the required courses in the Nursing Anesthesia program.

Applications

Application forms are available from the Nursing Anesthesia Program, 2300 Eye Street, N.W., Washington, D.C. 20037, (202)676-3543. Completed applications must be returned no later than May 15.

PHYSICIAN ASSISTANT PROGRAM

The program leading to the degree of Bachelor of Science with a major in the Physician Assistant program is offered to on-campus students and to off-campus military students and requires the satisfactory completion of 120 semester hours of course work.

Admission Requirements

The general requirements for admission to the program are stated on pages 47–49. In addition, applicants must submit evidence of satisfactory completion of two semesters of general chemistry, two semesters of psychology, and two semesters of biological sciences (the latter may include general biology, anatomy, microbiology, or zoology but will not include botany); completion of one year (2,000) hours of patient care experience; and three letters of recommendation. A personal interview is also required.*

Scholarship Requirements

Scholarship requirements are stated on page 65. Candidates for the degree of Bachelor of Science with a major in the Physician Assistant program must maintain a cumulative QPI of 2.00 for course work taken in the Physician Assistant program. A cumulative QPI of 2.50 is required for the courses in the core curriculum (see below). Each student must successfully complete all courses for which he or she is registered in any given semester before being allowed to advance to the next semester.

Residence Requirement†

A minimum of 75 semester hours in the preclinical and clinical portions of the major must be completed in residence at the School of Medicine and Health Sciences.

Advanced Standing

Advanced standing does not apply to courses in the major; advanced standing toward the baccalaureate degree, however, may be awarded for appropriate course work completed previously at another academic institution with a minimum grade of *C*.

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* Not applicable to off-campus military students.
† Off-campus military students should consult page 71 for residence requirements.

Degree Requirements*

Satisfactory completion of a minimum of 120 semester hours is required for the Bachelor of Science degree with a major in the Physician Assistant program. Course work is distributed as follows:

Human Competence—30 semester hours: 6 hours in English composition (Engl 9 or 10 and 11 or 12); 24 hours of course work selected from the three following areas: humanities, social sciences, or mathematics (algebra, geometry, trigonometry, and calculus).

Subject and Vocational Competence—92 semester hours:
Basic Health Sciences—Anat 115; Bioc 111; Micr 128; Path 129, 152; Phar 158; Phyl 111.
Basic Clinical Sciences—HCS 109, 119, 125,† 134,† 137, 140, 145, 146, 147, 148, 151.
Clinical Clerkship—HCS 160,† 163,† 166, 169, 172,† 175,† 178, 198, 199.
Other Required Courses—HCS 113, 116.

Certificate

A certificate will be awarded to students upon successful completion of the required courses in the Physician Assistant program.

Applications

Application forms are available from the Physician Assistant Program, 1229 25th Street, N.W., Washington, D.C. 20037, (202)676-4034, beginning each year in September. Completed applications should be returned no later than the first Monday in February.

OFF-CAMPUS MILITARY STUDENTS

The Bachelor of Science Degree with a major in the Physician Assistant program is also offered to off-campus military personnel. Military students in the off-campus program must complete the following courses:

Human Competence—30 semester hours: 6 semester hours in English composition; 24 semester hours in the humanities and social sciences.

Subject and Vocational Competence—90 semester hours:
Basic Health Sciences—HCS 111, 120, 121, 151.†
Basic Clinical Sciences—HCS 109, 127,† 128,† 129,† 134,† 137, 146, 147, 148.
Clinical Clerkships—HCS 167,† 169, 172,† 174,† 189 or 199, 190, 191, 192, 198.
Other Required Courses—A minimum of 30 semester hours of didactic course work must be completed in the areas of biological and physical sciences. This requirement will be satisfied by successful completion of Advanced Hospital Corps School (NEC 8425) or comparable course work.

RADIOLOGIC SCIENCES AND ADMINISTRATION PROGRAM

The program leading to the degree of Bachelor of Science with a major in Radiologic Sciences and Administration requires the satisfactory completion of a minimum of 120 semester hours of course work. This program is designed for registered technologists in diagnostic radiologic technology, nuclear medi-

* Off-campus military students should refer to Off-Campus Military Students section below for degree requirements.
† Designates core curriculum courses, which must be completed with a cumulative QPI of 2.50.

cine technology, ultrasound, or radiation therapy technology who wish to continue their education at the baccalaureate level.

Admission to Degree Candidacy

The general requirements for admission to degree candidacy are stated on pages 47–49. In addition, students applying to the program must be registered technologists or registry-eligible within the first academic semester. A personal interview and two letters of recommendation from previous instructors, supervisors, or employers should accompany the application.

Advanced Standing

A maximum of 48 semester hours of advanced standing may be granted under the following conditions:

1. If the student's technical training was completed within the last five years. However, the student must have maintained a QPI of at least 3.0 percent from a program in radiologic technology, nuclear medicine technology, or radiation therapy (accredited by the Joint Review Committee on Educational Programs in Radiologic Technology, Nuclear Medicine Technology, or Radiation Therapy of the Council on Medical Education of the American Medical Association).
2. If the student has been certified as an American Registered Technologist, Nuclear Medicine Technologist, or Radiation Therapy Technologist.
3. If the student becomes registry-eligible during his or her first academic semester at The George Washington University.

Scholarship Requirements

Scholarship requirements are stated on page 65. Students must maintain a cumulative QPI of 2.50 in the core curriculum.*

Degree Requirements

Human Competence—A minimum of 30 semester hours is required, including BiAd 102, 105; Engl 9 or 10 and 11 or 12; Psyc 1; Soc 1; 6 hours of social sciences and 6 hours of humanities. Recommended electives include Engl 101; Hum 26; Psyc 151; Soc 129; SpDr 111, 121.

Subject and Vocational Competence—A total of 92 semester hours is required. Of these, a maximum of 48 semester hours is allowed for course work in an American Medical Association approved program in either diagnostic radiologic technology, nuclear medicine technology, or radiation therapy technology. The remaining 44 semester hours consist of the following required courses:

Radiologic Sciences—ClEn 101; Rad 092, 167, 171, 175, 176, or 177, 190, 195; *Radiologic Administration*—HSA 142, 153, 154, 170; Psyc 144; Rad 140, 145, or 147 or 149; Soc 124.

Applications

Application forms are available from the Radiologic Allied Health Program, 2300 Eye Street, N.W., Washington, D.C. 20037, (202)676-3650, and should be completed and returned no later than March 1 each year.

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* That is, all courses listed under *Subject and Vocational Competence*.

Required or Recommended Courses in Allied Health Programs Offered in Other Divisions of the University*

Students should consult with their academic advisor on required courses for allied health students that are offered either by Columbian College of Arts and Sciences or by the School of Government and Business Administration. The program coordinators in the Office of Allied Health Administration will provide assistance in choosing electives appropriate for the student's particular program. These may be selected from a wide array of offerings in the humanities, mathematics, and social sciences. See the University's *Undergraduate and Graduate Bulletin* for a complete list of course descriptions.

* Off-campus military students should consult with the program coordinator for assistance in selecting electives and required courses at other institutions.



SCHOOL OF MEDICINE AND HEALTH SCIENCES COURSES OF INSTRUCTION

The School of Medicine and Health Sciences serves other divisions of the University by making available to nonmedical students certain undergraduate and graduate courses in the following departments: anatomy, biochemistry, microbiology, pathology, pharmacology, and physiology. The courses listed represent those offered as of September 1981 and are subject to change. The University reserves the right to withdraw any course announced.

STAFF OF INSTRUCTION

The Staff of Instruction listed under each department and at the back of this *Bulletin* is current as of July 1981.

EXPLANATION OF COURSE NUMBERS AND SYMBOLS

A number in parentheses after the name of the course indicates the number of semester hours of credit which may be earned. Five semester hours of credit per four-week elective period are granted for all fourth-year courses in the M.D. program.

Courses numbered from 1 to 100 are for first- and second-year undergraduate Allied Health students. Courses numbered from 101 to 200 are for third- and fourth-year undergraduate Allied Health students. Courses in the basic science departments numbered from 201 to 400 are for candidates for the M.D. degree and for students in the Graduate School of Arts and Sciences. All other courses numbered from 201 to 400 are primarily for candidates for the M.D. degree.

KEY TO ABBREVIATIONS

The following abbreviations are used by the University for course designations.

Acct	Accounting	**Art**	Art
AmCv	American Civilization	**ArTh**	Art Therapy
Anat	Anatomy	**Bioc**	Biochemistry
Anes	Anesthesiology	**BlSc**	Biological Sciences
Anth	Anthropology	**BAd**	Business Administration
ApSc	Applied Science	**Cart**	Cartography

Chem	Chemistry
CH&D	Child Health and Development
Chin	Chinese
CE	Civil Engineering
Clas	Classics
ClEn	Clinical Engineering
CSci	Computer Science
Derm	Dermatology
Econ	Economics
Educ	Education
EPol	Education Policy
EE	Electrical Engineering
EAd	Engineering Administration
EngS	Engineering Science
Engl	English
EFL	English as a Foreign Language
EnHe	Environmental Health
Envr	Environmental Studies
Hum	Experimental Humanities
ForS	Forensic Sciences
Fren	French
Gnet	Genetics
Geob	Geobiology
Geod	Geodesy
Geog	Geography and Regional Science
Geol	Geology
Ger	Germanic Languages and Literatures
Gern	Gerontology
HCS	Health Care Sciences
HSA	Health Services Administration
Hist	History
HKLS	Human Kinetics and Leisure Studies
Idis	Interdisciplinary Courses
IAf	International Affairs
Ital	Italian
Japn	Japanese
Jour	Journalism
Law	Law
Mgt	Management Science
Math	Mathematics
ME	Mechanical Engineering
M&PA	Medical and Public Affairs
Med	Medicine
Micr	Microbiology
MStd	Museum Studies
Mus	Music
NSur	Neurological Surgery
Neur	Neurology
Ob&G	Obstetrics and Gynecology
Ocea	Oceanography
OR	Operations Research
Opth	Ophthalmology
Oral	Oral Biology
Orth	Orthopaedic Surgery
Otol	Otolaryngology
Path	Pathology
Phar	Pharmacology
Phil	Philosophy
Phys	Physics
Phyl	Physiology
PCm	Political Communications
PSc	Political Science
Port	Portuguese
Pchi	Psychiatry and Behavioral Sciences
Psyc	Psychology
PAd	Public Administration
RSci	Radiological Sciences
Rad	Radiology
RPol	Regulatory Policy
Rel	Religion
SLP	Service-Learning Program
Slav	Slavic Languages and Literatures
Soc	Sociology
Span	Spanish
SpEd	Special Education
SpDr	Speech and Drama
Stat	Statistics
Surg	Surgery
TCom	Telecommunication Operations
Univ	University
U&RP	Urban and Regional Planning
Urol	Urology
WStu	Women's Studies



Anatomy

Chairman: R.S. Snell

Professors E.N. Albert, F.D. Allan, T.N. Johnson, M.J. Koering, R.S. Snell
Professorial Lecturers J.L. Angel, M.W. Brightman, T.S. Reese
Associate Professors K.E. Johnson, D.B. Parsons *(Research)*, F.J. Slaby
Associate Professorial Lecturers J.A. Di Paolo, M.F. Ericksen
Assistant Professors R.C. Bohn, K.D. Pevsner, J.M. Rosenstein, R.J. Walsh

115 **Anatomy for New Health Practitioners** (3) Staff
Gross and microscopic structure of human body, including musculoskeletal, nervous, endocrine, cardiovascular, respiratory, gastrointestinal, urinary, and reproductive systems. Laboratory work is limited to prosected anatomical demonstrations.

202 **Gross Anatomy** (6) Snell and Staff
For graduate students. Regional dissections of adult cadaver supplemented with lectures and x-rays. Laboratory fee, $30. (Fall)

203 **Human Developmental Anatomy** (1) K. Johnson
(Formerly Human Embryology)
For graduate students. Origin and development of human body; emphasis on value of embryology in interpreting anatomical anomalies. (Fall)

204 **Neuroanatomy** (2) T. Johnson
For graduate students. Gross and microscopic anatomy of central nervous system and special senses. Students who have received credit for Anat 204 may not register for Anat 212. Laboratory fee, $13. (Fall)

205 **Human Microscopic Anatomy** (3) Albert and Staff
For graduate students. Microscopic structure of cells, tissues, and organs of the human body. Laboratory fee, $20. (Fall)

206 **Scanning Electron Microscopy** (2) Koering
Preparative techniques for various biological tissues, operation of scanning electron microscope, and interpretation of micrographs. Laboratory fee, $30. Enrollment limited. Prerequisite or concurrent registration: Anat 260. (Fall)

208 **Comparative Vertebrate Neurology** (1) T. Johnson
For graduate students. Survey of the evolution of the vertebrate brain. Prerequisite: Anat 204. Laboratory fee, $10. (Spring)

209 **The Use of Audiovisual Techniques in Anatomy** (2) Allan
For graduate students. Preparation of a significant audiovisual program of some aspect of human anatomy. Laboratory fee, $20. (Spring)

212 **Neurobiology** (3) Staff
For graduate students. Same as Idis 212 and Phyl 212. Integrated survey of the structure and function of the human nervous system. Lecture, clinical demonstration, and laboratory. Laboratory fee, $25.

*213 **Gross Anatomy** (6) Staff
(Fall)

*214 **Microscopic Anatomy** (3) Staff
(Fall)

*215 **Human Developmental Anatomy** (1) Staff
(Fall)

* Required for medical students.

221–22 **Seminar** (1–1) Staf
For graduate students. Research reports and discussions of special topics by guest lecturers, staff, and graduate students. Medical students encouraged to attend. (Academic year)

249 **Introduction to Anatomical Research** (1) Staf
For graduate students. Major research techniques as applied to biological materials in the various anatomical disciplines. (Fall)

252 **Physical Anthropology** (1) Angel
Variations in humans and factors affecting them, human evolution and racial differences, anatomy and culture of ancient man. (Spring)

253 **Brain Tissue Interactions** (1) Walsh and Rosenstein
Lectures on interactions of the CNS with muscular, sensory, and endocrine systems. Student presentations and clinical aspects will be included. (Spring)

254 **Fetal Anatomy** (2) Allan
Dissection of the midgestational human fetus. Comparison of fetal and adult structures. 20 students. Laboratory fee for nonmedical students, $10. (Spring)

255 **Tissues of the Body** (1) Albert and Staf
Detailed current information on various organ systems. Prerequisite: Anat 214 or equivalent. (Spring)

256 **Teratology** (1) K. Johnson
Etiology and mechanisms of common congenital malformations. Limited enrollment.

260 **Electron Microscopy in Cellular Biology—Lecture** (1) Koering
Introduction to the morphology of the cell and its relationship to electron microscopic techniques. (Spring)

261 **Transmission Electron Microscopy** (3) Koering
Introduction to the routine processing of specimens; preparation and interpretation of micrographs. Limited enrollment. Admission by permission of instructor. Prerequisite or concurrent registration: Anat 260. Laboratory fee, $25. (Fall and spring)

262 **Gross Anatomy of Upper and Lower Extremities** (2) Snell and Staf
Detailed dissection, supplemented by x-ray anatomy; discussions, assigned reading. Limited enrollment. Laboratory fee for nonmedical students, $10. (Spring)

264 **Gross Anatomy of Head and Neck** (2) Staf
Detailed dissection, supplemented by x-ray anatomy; discussions, assigned reading. Limited enrollment. Laboratory fee for nonmedical students, $10. (Spring)

265 **Clinical Cell Biology and Electron Microscopy** (5) Alber
Investigation into clinical problems concerning atherosclerosis. 4-week elective periods. Snell

266 **Gross Anatomy of Thorax and Abdomen** (2)
Detailed dissection, supplemented by x-ray anatomy; discussions, assigned reading. Limited enrollment. Laboratory fee for nonmedical students, $10. (Spring)

268 **Gross Anatomy of Pelvis, Perineum, and Lower Extremity** (2) Snell and Staf
Detailed dissection, supplemented by x-ray anatomy; discussions, assigned reading. Limited enrollment. Laboratory fee for nonmedical students, $10. (Spring)

270 **Dissection of the Human Brain** (1) **T. Johnson**
Dissection of major pathways and nuclei of the brain with consideration of ventricular system; conferences and assigned reading. Limited enrollment. Laboratory fee for nonmedical students, $10. (Spring)

272 **Autonomic Nervous System** (1) **Allan**
Development, microscopic and gross anatomy, function of central and peripheral components of autonomic nervous system. (Spring)

275 **Advanced Human Embryology** (1) Allan
Microscopic examination of the human embryo at several critical periods during embryogenesis. Prerequisite: Anat 203. Limited enrollment. (Spring)

276 **Advanced Studies in Anatomy** (1) **Staff**
Lectures and conferences on selected anatomical subspecialties—endocrinology, teratology, growth, etc. May be repeated for credit. (Spring)

279 **Applied Regional Anatomy** (5) **Snell**
Regional dissection, guided readings, weekly discussions. 4-week elective periods.

282 **Advanced Neuroanatomy** (5) **T. Johnson**
Dissection of the human brain, study of slides of the central nervous system, and an introduction to neurological research. 4-week elective periods.

284 **Applied Surface Anatomy and Radiology** (5) **Snell**
Detailed study of anatomical structures which are accessible to examination in the living subject; normal radiology of the body. 4-week elective periods.

285 **Application of Audio-Visual Techniques to Anatomy** (5) Allan
Students identify, develop, and produce an audio-visual program on a clinically important facet of human anatomy: gross, microscopic, developmental, or neuroanatomical. 4-week elective periods.

288 **Surface Anatomy and Radiology** (1) **Snell**
Lectures and demonstrations on areas of clinical importance.

291 **Special Projects in Anatomy** (5) **Snell**
Independent study on an aspect of gross anatomy. 4-week elective periods.

295 **Research** (arr.) **Staff**
Content differs each time course is offered; may be repeated once for credit. Fee to be arranged. (Fall and spring)

299 **Biochemical and Morphological Techniques in Cell Biology** (3) **Slaby**
Techniques currently used in the isolation of subcellular fractions and their biochemical and morphological characterization.

398 **Advanced Reading and Research** (arr.) **Staff**
Limited to students preparing for the Doctor of Philosophy general examination. May be repeated for credit. (Fall and spring)

399 **Dissertation Research** (arr.) **Staff**
Limited to Doctor of Philosophy candidates. May be repeated for credit. (Fall and spring)

Anesthesiology

Chairman: C.S. Coakley

Professors S. Alpert, C.S. Coakley, J.B. Craft, Jr., B.S. Dunbar, B.S. Epstein, M.W. Lichtmann, W.L. Marsh, P. Mazel, G.A. Morales, R.J. Van Houten, H.D. Weintraub, J.E. Zimmerman

Associate Professors A.H. Altstatt, S.S. Edelstein, A.I. Fields, R.S. Hannallah, P.R. Holbrook, M.L.L. Kennedy, W.A. Knaus, D.S. Lee, W.A. McGill, T.J. Nassif, T.H. Oh, M.J. Shaffer, S.R.P. Watson

Adjunct Associate Professor R.H. Norton

Associate Clinical Professors S.N. Albert, H.F. Nicodemus

Assistant Professors M.D. Abramowitz, A.S. Anderson, M.J. Becker, A.G. De Laney, M.T. Karna, G.W. Mergner, V.V. Ott, S.V. Petkov, M.M. Pollack, L.G. Welborn

Adjunct Assistant Professors R.L. Barth, C.C. Yu

Assistant Clinical Professors C.A. Albert, B.E. Economopoulos, H.W. Manitsas, T.G. Rainey

Instructor R.I. Patel

Courses numbered 190 through 198 are for nursing anesthesia students.

190 **Seminar: Anesthesiology** (4) Staff
Small discussion groups on morbidity and mortality from actual and reported cases. Topics related to complications of anesthesia.

191 **Respiratory Care** (3) Staff
Advanced techniques for the care of patients requiring total prolonged respiratory support.

192 **Orientation for Anesthesia** (0) Staff
Lecture, group discussion, and audiovisual presentation. History of anesthesia, legal aspects, ethics, psychology, professional adjustments, department management, and organization.

193 **Methods and Procedures in Anesthesia** (4) Staff
At affiliated hospitals. Lecture, group discussion, and audiovisual presentation. Anesthesia techniques, positions in anesthesia, types of anesthetic required to meet the needs of different surgical specialties, and related topics.

194 **Principles of Clinical Anesthesia** (26) Staff
Twelve-month course at affiliated hospitals. Supervised clinical training and experience. The student is assigned patients, organizes and administers anesthesia, and follows the patients through their total hospitalization. Designed to satisfy the American Association of Nurse Anesthetists requirements.

195 **Electronics for Medical Personnel** (2) Staff
Introduction to fundamental principles used in electronic instrumentation for monitoring patient status in operating room and intensive care units. Power, biomedical voltages and transducers, blood pressure and heart rate monitors, displays, telemetry, special purpose instruments, safety hazards analysis techniques for technical equipment procurement. (Fall)

198 **Pathological Physiology and Anesthesia** (3) Staff
Review of patho-physiology of major organ systems in relation to anesthesia. Clinical implications of various disease states, their interactions with anesthetics, and effects on anesthetic management.

210 **Anesthesiology Research Laboratory** (2) Craft and Mergner
Participation in and observation of the various aspects of laboratory research, including anesthesia, surgery, physiology, pharmacology, and research techniques.

211 **Biomedical Equipment Elective** (2) Shaffer
(Formerly 1 credit)
Concepts of operation and theoretical and practical applications of biomedical electronic and respiratory equipment used in patient diagnosis, therapy, and monitoring. (Spring)

*302 **Clinical Clerkship** (3) Staff
Clinical preoperative evaluation, surgical and obstetrical anesthesia, infant and adult resuscitation, inhalation therapy, management of patients in coma, shock, and other problems which may be encountered in medical practice. 1 week—Univ. Hosp., 1 week—Walter Reed Gen. Hosp. or Wash. Hosp. Center. (2-week periods throughout academic year)

380 **Anesthesiology** (5) Morales
Clinical experience in preoperative evaluation; surgical, obstetrical, neurosurgical anesthesia; infant and adult resuscitation; inhalation therapy; monitoring and blood gas determinations. 4-week elective periods. Univ. Hosp.

381 **Cardiovascular Anesthesia** (5) Mergner
Clinical experience in the total perioperative evaluation and management of patients with significant cardiovascular disease (open heart, major vascular, or other surgery). Techniques of data evaluation from major hemodynamic monitoring. May include participation in ongoing clinical or laboratory research projects. 4-week elective periods. Univ. Hosp.

382 **Neurosurgical Anesthesia** (5) Lee
Principles of clinical management of the neurologic patient in the perioperative period. Physiology and pharmacology of intracranial pressure and cerebral blood flow and metabolism. Intracranial pressure monitoring and the effects of respiratory nursing, and physiotherapy maneuvers on neurosurgical patients. Participation in research projects in both OR and ICU may be involved. 4-week elective periods. Univ. Hosp.

383 **Obstetrical Anesthesia** (5) Craft
Principles of the clinical management of the obstetrical patient in the peridelivery period. Physiologic alterations of pregnancy and perinatal pharmacology. Participation in the research laboratory using the chronic maternal-fetal sheep preparation, and in clinical research projects. 4-week elective periods. Univ. Hosp.

384 **Intensive Care Unit** (5) Zimmerman
Evaluation and management of respiratory failure, rationale and use of automatic ventilators, chronic airway management, cardiovascular support, and intensive care. 4-week elective periods. Univ. Hosp.

386 **Intensive Care Unit** (5) Staff
Evaluation and management of respiratory failure, rationale and use of automatic ventilators, airway management, cardiovascular support techniques, and intensive care medicine. 4-week elective periods. Nat'l Naval Med. Center.

390 **Extramural Anesthesiology Elective** (arr.) Morales
The department arranges for students to spend elective periods at other institutions. Interested students should contact Dr. George Morales.

* Required for medical students.

Biochemistry

Chairman: A.L. Goldstein

Professors J.M. Bailey, A.L. Goldstein, D.H. Pluznik *(Visiting)*, B.W. Smith, G.V. Vahouny

Adjunct Professors L. Prosky, G.B. Thurman

Clinical Professor O.I. Dodek, Jr.

Professorial Lecturers E.P. Anderson, P.H. Fishman, G. Guroff, P.J. Marangos, C.R. Merril, A.N. Schechter, J.C. Smith, Jr., E. Steers, Jr.

Associate Professors R.W. Bryant, Jr. *(Research)*, L.L. Gallo, A. Kumar, R.E. Lockard *(Research)*, T.L.K. Low *(Research)*, G.A. Walker

Adjunct Associate Professors J.N. Ihle, M.M. Zatz

Assistant Professors N.R.S. Hall *(Research)*, D. Irwin *(Research)*, C.E. Low *(Research)*, T.W. Moody, R.A. Muesing *(Research)*, R.S. Schulof, J.Y. Vanderhoek *(Research)*

101 **Chemistry for Allied Health Science** (2) Trichilo
For Allied Health students. Basic concepts of general and organic chemistry. (Fall)

111 **Biochemistry for Allied Health Science** (4) Walker
For Allied Health students. Basic concepts of biochemistry and their relation to the allied health field. (Fall)

*201 **Medical Biochemistry** (8) Walker and Staff
For medical students only. Lecture and laboratory; emphasis on basic principles and their relation to medicine. (Fall)

205 **Biochemistry of Organ Function** (1) Kramer
For medical students; open to limited number of graduate students. Emphasis on biochemical processes unique to particular organ systems; application of these processes to evaluation of function. (Spring)

207 **Human Nutrition** (1) Gallo, Treadwell, Walker
Seminar course for medical students. Application of nutritional principles to clinical problems. (Spring)

208 **Extramural Biochemistry Elective** (arr.) Walker
The department arranges for medical students to spend elective periods at other institutions. Interested students should contact the coordinator of medical biochemistry. (Fall and spring)

209 **Research Elective in Medical Biochemistry** (arr.) Staff
For senior medical students. Research in areas currently under investigation in the department. 8-week elective periods. Interested students should contact the coordinator of medical biochemistry. (Fall and spring)

211 **Readings in Human Nutrition** (3) Staff
For senior medical students. Directed readings in human nutrition. (Spring)

212 **Readings in Cell and Molecular Biology** (arr.) Kumar
For senior medical students. Directed readings on current research work in recombinant DNA and the application of gene cloning in the understanding of selected clinical disorders. (Fall and spring)

213 **Readings in Immunology** (arr.) Goldstein
For senior medical students. A directed reading course in clinical immunology. (Fall and spring)

* Required for medical students.

221–22 **General Biochemistry** (3–4) Gallo and Staff
A comprehensive course in general biochemistry for graduate students in biomedical sciences and undergraduate students in biology and chemistry. Prerequisite: Chem 152, 154. (Academic year)

225–26 **Introduction to Biochemical Research** (2–4) Smith and Staff
Rotation through research projects in laboratory units within the Biochemistry Department to provide individualized in-depth training in the methods and instrumentation used in those units. Limited to students in the Department of Biochemistry graduate program. (Academic year)

227 **Biochemistry Seminar** (1) Bryant and Vanderhoek
Current literature in biochemistry. Open to graduate students in the biomedical sciences and to a limited number of medical students. May be repeated for credit. (Fall and spring)

229 **Biochemistry of Enzymes** (2) E. Anderson
Content includes practical handling of enzymes, kinetics, reaction mechanisms, active site, isozymes, regulation, and other special topics. Prerequisite: Bioc 201 or 221. (Spring)

230 **Current Topics in Enzymology** (2) Bailey and Staff
Directed readings in various areas of enzymology. May be repeated for credit. Prerequisite: Bioc 229.

231 **Bioenergetics** (2) Staff
Content includes laws of thermodynamics, application of these laws to biological systems; oxidation—reduction processes and other special topics. Prerequisite: Bioc 221–22. (Fall)

232 **Protein Chemistry** (2) Steers and Schechter
Content includes the theory and methods of protein chemistry, the structure-function relationship of proteins, and other special topics. Prerequisite: Bioc 201 or 221. (Fall)

240 **Nutrition** (2) Walker and Staff
Content includes discussion of RDA, nitrogen-balance, vitamins and minerals, diets, and other special topics. Prerequisite: Bioc 201 or 221–22. (Spring)

241 **Current Topics in Nutrition** (2) Walker and Staff
Directed literature readings in various areas of nutrition. May be repeated for credit. Prerequisite: Bioc 240.

250 **Cell and Molecular Biology** (2) Kumar and Staff
Content includes the organization and replication of genetic material, transcriptional and translational machinery, regulation of eukaryotic gene expression, and other special topics. Prerequisite: Bioc 201 or 221–22. (Fall)

251 **Current Topics in Molecular Biology** (2) Kumar and Staff
Directed readings in the area of molecular biology. May be repeated for credit. Prerequisite: Bioc 250.

252 **Biochemical and Molecular Aspects of Selected Diseases** (2) Irwin and Staff
Emphasis on the biochemical and molecular aspects of selected major diseases. The format will be of a tutorial type, including presentations of material by students. (Spring)

260 **Lipids** (2) Gallo and Vanderhoek
Content includes the biosynthesis, metabolism, and functions of lipoproteins, prostaglandins, and other special topics. Prerequisite: Bioc 221–22. (Spring)

261 **Current Topics in Lipids** (2) Vahouny and Staff
Directed readings in the area of lipid biochemistry. May be repeated for credit. Prerequisite: Bioc 260.

263 **Steroids** (2) Dodd
For medical students; open to a limited number of graduate students. Content includes chemistry of steroids pathways of biosynthesis and metabolism, clinical manifestations of steroid unbalance, steroid changes in pregnancy, and other special topics. Prerequisite: Bioc 201 or 221–22. (Spring)

270 **Biochemistry of the Immune Response** (2) Goldstein and Staff
Immunoglobulin structure, function, and regulation; complement system; biochemistry of mediators of cellular immunity; molecular biology of cell differentiation of the immune system. Prerequisite: Bioc 201 or 221–22. (Spring)

271 **Current Topics in Immunology** (2) Goldstein and Staff
Directed readings in the area of biochemical immunology. May be repeated for credit. Prerequisite: Bioc 270.

280 **Biochemistry of Nerve Tissue** (2) Moody and Staff
Content includes molecular structure and function of nerve tissue, intra- and interneuronal communication mechanisms, biochemistry of various brain dysfunctions, and other special topics. Prerequisite: Bioc 201 or 221–22. (Fall)

295 **Research in Biochemistry** (arr.) Staff
Participation in a project under investigation in the department or one of a related field suggested by the student and approved by the staff. Content differs each time course is offered. May be repeated for credit. (Fall and spring)

299–300 **Thesis Research** (3–3) Staff
(Fall and spring)

398 **Advanced Reading and Research** (arr.) Staff
Limited to students preparing for the Doctor of Philosophy general examination. May be repeated for credit. (Fall and spring)

399 **Dissertation Research** (arr.)
Limited to Doctor of Philosophy candidates. May be repeated for credit. (Fall and spring)

Child Health and Development

Chairman: R.H. Parrott

Associate Chairmen: F.C. Green *(Child Health Advocacy)*, D.W. Delaney *(House Staff and Medical Care)*, J.L. Todaro *(Student Affairs)*, J.G. Randolph *(Surgical Division)*

Directors of Divisions: R.A. Sly *(Allergy)*, F.C. Green *(Ambulatory Medicine)*, L.P. Scott *(Cardiology)*, M.L. Elgart *(Dermatology)*, W. Hung *(Endocrinology)*, D.W. Delaney *(General Medicine)*, S. Leiken *(Hematology)*, R.S. Chandra *(Anatomical Pathology)*, J.M. Hicks *(Clinical Laboratories)*, G.B. Avery *(Neonatology)*, S.A. Shelburne, Jr. *(Neurology)*, G.D. Eng *(Physical Medicine)*, J.H. Egans *(Psychiatry)*, W.J. McSweeney *(Radiology)*, B.S. Ep

stein *(Anesthesiology)*, F.M. Midgley *(Cardiovascular Surgery)*, J.G. Randolph *(General Surgery)*, T.H. Milhorat *(Neurosurgery)*, D.S. Friendly *(Ophthalmology)*, D.W. McKay *(Orthopaedics)*, J.J. McFarland, Jr. *(Otolaryngology)*, L.W. Thompson *(Plastic Surgery)*, A.B. Belman *(Urology)*

Professors J.P. Adams, G.B. Avery, C.U. Battle, A.B. Belman, R.M. Chanock, C.K. Conners, D.W. Delaney, S.A. Doxiadis *(Visiting)*, B.S. Dunbar, J.H. Egan, A.H. Einhorn, M.L. Elgart, G.D. Eng, B.S. Epstein, D.S. Friendly, F.C. Green, G.R. Herer, J.M.B. Hicks, W. Hung, A.Z. Kapikian *(Research)*, R.B. Kurz, S.L. Leikin, M. Majd, D.W. McKay, W.J. McSweeney, T.H. Milhorat, N. Movassaghi, J.D. Noshpitz, J.E. Ott, R.H. Parrott, L.W. Perry, J.G. Randolph, G.C. Rosenquist, L.P. Scott III, S.A. Shelburne, Jr., J.B. Sidbury, Jr., R.M. Sly, P.J. Varghese, J.M. Wiener

Adjunct Professor A.M. Margileth

Clinical Professors S. Berman, A.B. Coleman, L. Cytryn, M. Feitel, W.A. Howard, J.J. McFarland, B. Olshaker, M.M. Parks, J.L. Rapoport, R.E. Rieger, S. Ross, M.F. Shore, J. Spurlock, W. Stark, B.M. Webb, S.I. Wolf

Professorial Lecturers M.E. Jenkins, J.L. Sever

Associate Professors K.D. Anderson, G.P. August, A.B. Barnet, R.L.O. Boeckx, C.D. Brandt, R.S. Chandra, G.J. Cohen, M.C. Edwards, C.B. Feinstein, A.I. Fields, A.B. Fletcher, M.A. Fletcher, F.M. Galioto, A.M. Glasgow, L.W. Greenberg, R.S. Hannallah, P.R. Holbrook, R.E. Johnsonbaugh, H.W. Kim, W.A. McGill II, F.M. Midgley, S.S. Nason, J.W. Oberman, D.W. Ochsenschlager, T.H. Oh, M.N. Ozer *(Research)*, M.M. Platt, B.M. Potter, W.J. Rodriguez, K.N. Rosenbaum, E.J. Ruley, S.R. Shapiro, T.J. Silber, L.W. Thompson, J.W.L. Todaro, S.R.P. Watson, I.P. Weiss, J.H. Wise, M.R.D. Wolf

Adjunct Associate Professor R.B. Kielich

Associate Clinical Professors T.H. Anders, G.A. Balfour, P.C. Brunschwyler, J.L. Chamberlain III, G.G. Cochran, R. Evans III, M.J. Fischer, D.J. Fishman, M.S. Glatt, H.R. Gold, S.I. Greenspan, V.L. Guandolo, G.W. Hardman, Jr., K.L. Kaplan, C.E.J. Kimball, L. Lefkowitz, J.L. Levine, I. Mahdavi, J.R.S. Malkin, A.E. Marans, W.S. McCurley, G.W. Mella, I.D. Milowe, A.J. Modlin, K.B. Nelson, B.H. Ong, F.A. Pedreira, P.T. Peebles, K. Ravenscroft, Jr., C.B. Robinowitz, M.E. Robinson, B.C. Straight, T.J. Sullivan, G.A. Tripp, A.R. Ugel

Associate Professorial Lecturer M. Engel

Assistant Professors M.D. Abramowitz, I.S. Baron-Starke, E.L. Bartlett, Jr., M.J. Becker, H.J. Bennett, H.W. Binder, G.H. Bock, M.A. Borengasser, D.R. Brallier, R.D. Castro, C.S.C. Chang, M.J. Chang, V.W.C. Cheng, B.A. Copeland, M.R. Eichelberger, T.C. Fearon, R.A. Felter, A.H. Ficker, R.J. Fink, J.L. Gaiter, R.S.K. Gluck, B.G. Gold, K.M. Grundfast, M.K. Hammock, N.M. Horstmann, V.S. Hubbard *(Research)*, S.H. Josephs, S.P. Kapur, M.T. Karna, E.J. Kass, J.F. Kelleher, Jr., H.L. Kincaid, B.M. Koch, A.B. Livingood, N.C. Luban, M.G. MacDonald-Ginzburg, D.B. Magilavy, M.M. Malawer, B.M. Markle, B.J. Maron *(Research)*, M.K. Miller, C.R. Mock, T.M. Murphy, S.L. Murray, C.M. Naulty, V.V. Ott, B.J. Peacock, M.M. Pollack, G.H. Reaman, R.B. Reff, C.M. Rogers, R.N. Ruckman, J.R. Salcedo, B.L. Short, L.F. Sorkin, K.E. Toomey, J.D. Van Brakle, L.A. Vitu-

Iano, M.J. Wagner, D.C. Watson, Jr., M.I. Weissman, L.G. Welborn, K.C. Wells, P.H. White

Adjunct Assistant Professor L.H. Haller

Assistant Clinical Professors D.G. Albert, M.S. Albert, S.C. Amiri, R.S. Bashian, L.M. Beard, W.R. Bond, Jr., M.E. Bravo, I. Brook, J.M. Burgin, I.M. Chatoor-Koch, C.L.C. Chisholm, L.F. Cohen, R.H. Coleman, T.M. Connor, L.A. Cove, G.W. Daisley, Jr., M.W. Datch, M.M. Davis, M.I. Feldman, M.R.J. Fox, T. Frey, W.A. Fried, S.L. Friedman, A. Gaisin, A.E. Gober, H.B. Gould, S.C. Goyal, A.P. Guarinello, E.J. Hager, D.P. Harburger, J.K. Hurley, G. Joseph, R.A. King, A.J. Kinnane, B.J. Landau, P.C. Latkin, M.E. Lederman, R.P. Lekagul, J.A. Lowe, T.J. Lustberg, H.A. Margold, R.L. McDowell, Jr., D.H. McKnew, Jr., H.M. Meagher, E.S. Merz, R.J. Mier, J.F. Morales, P.J. Nachajski, R.A. Nover, J.F. O'Neill, M.R. Ortega, S.M. Passman, E.A.G. Pinder, V.E. Powell, C.A. Renschler, R.S. Rixse, C.A.B. Schulman, R.H. Schwartz, A.E. Schweitzer, B.A. Shaver, K.O. Simrel, R.L. Steerman, A.H. Stein, F. Strassburger, A. Tantisunthorn, E.S. Taylor, I.C. Williams, S.B.W. Wooten, A.B. Zients

Instructors M.F. Altieri, R.I. Patel, M.D. Tolpin *(Research)*

Adjunct Instructor E.A. Black

Clinical Instructors S.O. Barr, G.J. Bergman, L.H. Bland, J. Bloom-Feshbach, B.S. Bruner, O.P. Chhabra, S.J. Coleman, Jr., P.A. Coyne, R.A. De Vine, Curcio, K.Z. Fowler, E.M. Hall, J.A. Hoberg, H.L. Kaftarian, S.S. Kessel, G.M. Korengold, D.R. Miller, V.A. Moyer, T. Sait, P.C. Sandiford, S.A. Shanahan, D.A. Siegel, F.L. Stroud, J.A. Vander Walde, A.R. Vinitsky, H.T. Vollero, S. White, N.M. Zaldivar

Special Lecturers J.H. Bayly, C.M. Berlin, J.D. Blake, E.J. Feroli, A.L. Knasel, M.I. Michael, M.I. Mones, E.G. Moses, M. Schuelein, I. Seiler, R.B. Shearin, Greenberg

*303 **Pediatric Clerkship** (10)
Full-time, as part of resident team; ward rounds; work in outpatient department and specialty clinics under staff supervision; child psychiatry and child guidance, lectures, clinical conferences, grand rounds. Children's Hosp. (Annual, continuous 8-week rotation)

360 **Clinical Pediatrics Acting Internship: Adolescent Unit** (5) Einhorn
4-week elective periods. Children's Hosp.

361 **Clinical Pediatrics Acting Internship: Infectious Diseases** (5) Einhorn
4-week elective periods. Children's Hosp.

362 **Clinical Pediatrics Acting Internship: General Medicine** (5) Einhorn
Children aged 2 months–3 years. 4-week elective periods. Children's Hosp.

363 **Clinical Pediatrics Acting Internship: General Medicine** (5) Einhorn
Children aged 3 months–12 years. 4-week elective periods. Children's Hosp.

364 **Clinical Pediatrics Acting Internship: Outpatient** (5) Einhorn
4-week elective periods. Children's Hosp.

365 **Clinical Pediatrics Acting Internship** (5) Van Brakle
Ward and ambulatory services. Lectures, conferences, rounds. 4-week elective periods. Holy Cross Hosp.

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* Required for medical students.

371 **Pediatric Gastroenterology** (5) Einhorn
In-patient and out-patient management of infants and children with gastrointestinal disease. Common procedures performed in gastroenterology (endoscopy, jejunal biopsy, liver biopsy, sigmoidoscopy). 4-week elective periods. Children's Hosp.

372 **Pediatric Out-Patient Medicine** (5) Cohen
Diagnosis and management of common ambulatory problems under the supervision of an attending physician and senior resident. 4-week elective period. Children's Hosp.

373 **Pediatric Urology** (5) Belman
Participation in clinical approaches on an inpatient and outpatient basis. Assessment, diagnostic evaluation, and participation in surgical problems. 4-week elective periods. Children's Hosp.

374 **Pediatric Orthopaedic Surgery** (5) McKay
4-week elective periods. Children's Hosp.

375 **Pediatric Surgery** (5) Randolph
Participation in an active, closely supervised surgical service for infants and children, including congenital defects, cardiac surgery, trauma, and neoplasms. 4-week elective periods. Children's Hosp.

376 **Pediatric Neurology** (5) Shelburne
Participation in diagnostic and therapeutic studies on inpatients and outpatients. Rounds, conferences, seminars. 4-week elective periods. Children's Hosp.

378 **Genetics** (5) Rosenbaum
Principles of basic human genetics with emphasis on the dysmorphic child, chromosomal aberrations, and genetic counseling. Opportunity to work in the genetic laboratory and to learn chromosomal techniques. 4-week elective periods. Children's Hosp.

379 **Pediatric Intensive Care** (5) Holbrook, Fields, Pollack
Clinical and didactic material on the pathophysiology and treatment of life-threatening illnesses, conditions, or injuries in childhood. Limited patient responsibility, extensive patient contact. Night call arranged individually. 4-week elective periods. Children's Hosp.

380 **Development Disabilities** (5) Battle
Theoretical issues of development, clinical appraisal, and intervention strategies for disability in vision, audition, motor functions, cognition, language, feeling, and affective development. Intensive review of normal development in all areas. Weekly reading assignments, written projects, and tutorial discussion sessions. Hosp. for Sick Children.

381 **Pediatric Allergy and Immunology** (5) Sly
Introduction to pediatric allergy and clinical immunology; clinics and wards. Some experience in experimental techniques, pulmonary function testing, and objective methods of clinical evaluation. Children's Hosp.

382 **Pediatric Radiology** (5) McSweeney
Participation in conferences and observation in the department; conventional and newer non-conventional body imaging teachniques are stressed in problem solving in pediatric medicine. 4-week elective periods. Children's Hosp.

383 **Pulmonary Medicine** (5) Fink
Detailed diagnostic and therapeutic procedures including pulmonary and nutritional manifestations and complications in cystic fibrosis patients from the newborn to those in their third decade. Medical, surgical, psychological, and social problems of cystic fibrosis patients and their families. 4-week elective periods. Children's Hosp.

385 **Child Psychiatry** (5) Ega
Observation of and appropriate participation in diagnostic, consultative and follow-up work with hospitalized children and psychiatric outpatients. Clinical and theoretical conferences. Orientation to community child psychiatry and child mental health as part of service delivery system. 4-week elective periods.

386 **Pediatric Hematology** (5) Fusaro
Clinical and laboratory studies of infants and children with hematologic disorders; bone marrow examinations. 4-week elective periods. Children's Hosp.

388 **Newborn Medicine** (5) Avery, Fletcher
Observation and participation in the intensive care of infants. 4-week elective periods. Children's Hosp.

389 **Pediatric Cardiology** (5) Scott, Perry
Physical diagnosis of congenital and acquired heart diseases, interpretation of electrocardiograms and vectorcardiograms, cardiac catheterizations. 4-week elective periods. Children's Hosp.

390 **Extramural Pediatric Elective** (arr.)
The department makes arrangements for students to spend elective periods at other institutions. Interested students should contact Dr. Arnold Einhorn after they have obtained the following: (1) a letter of approval from the Dean for Academic Affairs, (2) a description of the course of courses to be taken, and (3) a description of the affiliations of the other institution.

392 **Adolescent Medicine** (5) Silber
Outpatient clinical experience in diagnosis and management of problems of this age group, under supervision of senior staff and Fellows. Participation in consultative clinics, multidisciplinary interviewing conferences, medical teaching conferences, Adolescent Grand Rounds, and twice-weekly conferences with department chairmen. 4-week elective periods.

394 **Pediatric Clinical Laboratory** (5) Hicks
Laboratory studies of infants and children correlated with clinical disease. In-depth review of laboratory diagnostic studies. 4-week elective periods. Children's Hosp.

395 **Pediatric Endocrinology and Metabolism** (5) Hung, August, Glasgow
Observation of evaluation of patients with endocrine and metabolic disorders. Participation in planning of diagnostic and therapeutic programs for patients in an office setting. 4-week elective periods. Children's Hosp.

396 **Approach to Care of Child with Handicapping Condition** (5) Battle
Multidisciplinary approach to care of children with multiple handicaps, developmental delay, and/or chronic illness, in clinical assessments, therapy sessions, and interdisciplinary conferences. Reaction and behaviors of the child, family, and staff will be explored. Weekly reading assignments, written projects, and tutorial discussion sessions. Hosp. for Sick Children.

397 **Pediatric Nephrology** (5) Ruley
Clinical nephrology, hemodialysis, and research opportunities in immunologic causes of renal disease, complement abnormalities, vitamin D metabolism, acid-base physiology, renal physiology, and calcium metabolism. 4-week elective periods. Children's Hosp.

398 **Comprehensive Care** (5) Oberman
Participating in both sick- and well-child care as administered in a comprehensive setting, experience in multidisciplinary approach, cooperative planning with other community agencies. 4-week elective periods. Comprehensive Health Care Program.

Clinical Engineering

Chairman: W.S. Yamamoto

Professors H.V. Pipberger, W.S. Yamamoto
Adjunct Professors L.E. Lipkin, J.K. Weston
Professorial Lecturer B. Kemp
Associate Professors R.A. Dunn *(Research)*, W.A. Knaus, H.F. Orthner
Assistant Professors H.Z. Pipberger, *(Research)*, M.L. Severns

101 **Practical Computing for New Health Practitioners** (3) Orthner
For students majoring in radiologic science and administration. Designed to familiarize the student with computer systems, basic terminology, applications programming, and I/O equipment.

201 **Theory of Medicine** (arr.) Yamamoto
Inquiry into theoretical constructs intrinsic to practice of medicine. Discussion of nature of medical knowledge, its origins, organization and uses, and whether medical practice can be examined as having a formal structure. Emphasis is on decision theory and medical informatics. Elective, first-year medical students (1 semester hour). Independent study elective, 4th-year students (4 weeks, 5 semester hours). Warwick Bldg.

351 **Clinical Engineering for Medical Students** (5) Severns and Staff
Engineering technology as applied to medical problems. Tutorial instruction in the principles and practices of clinical engineering. Participation in current laboratory projects, assigned reading and study. Minicomputer and microcomputer hardware applications. Elective for first-, second-, and fourth-year medical students. 4-week elective periods for seniors. Warwick Bldg.

353 **Medical Computing** (5) Staff
Aspects of computer use, including preparation and execution of programs which involve clinical or research applications such as ECG analysis, medical file management, mathematical modeling, and managerial computing. In some cases, staff may be able to supervise a student in an area of the student's choice; in general, the program will consist of tutorial instruction. Elective for first-, second-, and fourth-year medical students. 4-week elective periods for seniors. Warwick Bldg.

354 **Automated Medical Measurement Systems** (5) Levin and Staff
Under supervision, the student will work in a multiphasic screening clinic and participate in the process of new implementations and in evaluation of the system. Seminar discussion of preventive medicine and occupational medicine. 4-week elective periods. Warwick Bldg.

390 **Extramural Clinical Engineering Elective** (arr.) Staff
The department sponsors fourth-year students spending one or more elective periods at other institutions. Programs must have the prior approval of the department staff.

Dermatology

Chairman: M. Elgart

Professor M. Elgart

Clinical Professors C.S. Brown, T.P. Nigra
Professorial Lecturer S.K. Gottlieb
Associate Professors M. Braun III, M.L. Turner
Adjunct Associate Professor A. Kornhauser
Associate Clinical Professors L.J. Eanet, D.E. Mitchell, P.L. Repetto, Jr., O.G. Rodman, A.R. Ugel
Assistant Professor C.M. Myrie
Assistant Clinical Professors S.H. Berk, M. Chadab, L.D. Cutler, R.N. De Angelis, A. Gaisin, H.S. Golomb, R.A. Katz, K.S. Korossy, A. Neimanis, S.M. Passman, D.L. Pierson, D.N. Robins
Clinical Instructors D.H. Isaacson, B.L. Patterson

380 **Dermatology Clinic** (5) Elgart
Conferences, lectures, and attendance at dermatology clinic where patients with wide variety of dermatoses are seen. Diagnosis and treatment of common skin disorders. Dermatologic surgical procedures, techniques for using liquid nitrogen, culture and identification of fungi, microscopic diagnosis of common cutaneous diseases. 4-week elective periods. Med. Fac. Assoc.

381 **Dermatology Clinic** (5) Mitchell
Same as Derm 380. 4-week elective periods. Group Health.

382 **Dermatology Clinic** (5) Rodman
Same as Derm 380. 4-week elective periods. Walter Reed Army Med. Cntr.

383 **Dermatology Clinic** (5) Neimanis
Same as Derm 380. 4-week elective periods. Andrews AFB Hosp.

385 **Dermatology in General Medicine** (5) Nigra
Dermatology as related to internal medicine. Mechanisms of diseases, in-depth approach to dermatologic-medical problems, advanced reading. 4-week elective periods. Wash. Hosp. Center.

386 **Private Office Practices** (5) Staff
4-week elective periods.

387 **Clinical Dermatology** (5) Fischman*
Introduction of clinical dermatology, by working in the outpatient dermatology clinic, observing inpatient consultations, reviewing histopathology, performing skin biopsies. Close supervision by staff. Interview required. 4-week elective periods. VA Hosp.

390 **Extramural Dermatology Elective** (arr.)
The department makes arrangements for students to spend 4-week elective periods at other institutions. Interested students should contact the chairman of the department.

Health Care Sciences

Chairman: J.E. Ott

Director of Division of Geriatric Medicine: V.A. Portnoi

Professors P.S. Birnbaum, F.C. Green, R.I. Keimowitz, J.C. LaRosa, J.E. Ott, T.E. Piemme, P.J. Steinglass

* Dr. Fischman is Chief of the Dermatology Service at the Veterans Administration Hospital.

Clinical Professor A.B. Rosenbaum
Associate Professors S.S. Edelstein, L.G. Pawlson, V.A. Portnoi, L.I. Sank, R.M.F. Southby, A.W. Stone, J.M. Wise
Adjunct Associate Professors F. Mullan, G.R. Ross, H.O. Scharpf
Associate Clinical Professors M.S. Beinfield, E.J. Hinman, R.A. Millington, H.L. Smits, S.J.N. Sugar
Associate Professorial Lecturers J.L. Falkson, T.M. Kao
Assistant Professors H.J. Bennett, B.C. Blatt, W.G. Boren, L.K. Davies, C.J. Davis, K.K. Davis, C.A. De Atley, M.S. Donaldson *(Research)*, R.A. Ferreras, H.D. Goldstein, D.A. Guida, J.K. Johnson, S.L. Lugerner, J.M. Mitchell, G.J. Povar, W.G. Reisz, R.K. Riegelman, L.P. Saladino, C.S. Shaffer, J.R. Shapiro, R.F. Shesser, M.S. Smith, C.T. Spiegel, W.A. Stein, H.M. Tape, G.P. Thomas, M.J. Wagner, M.I. Weissman
Adjunct Assistant Professors H.J. Beecham III, F.S. Curto, Jr., G.F. Hillegas III, T.G. Johnson, J.H. Nicklason, D.D. Patel, D.L. Pfeifer, J.H. Shelby, M.R. Silverman, R.M. Sweet, J.B. Zelman
Assistant Clinical Professors R.S. Ackart, D.S. Anderson, B. Avrunin, R.A. Berenson, T.G. Carlton, G.A. Chapnick, E. Diamond, N.K. Dysart, Jr., D.S. Edge, W.R. Ehrmantraut, R.L. Fassett, E.F. Gottlieb, A.P. Guarinello, R.D. Handy, J.A. Harman, W.O. Harrison, R.F. Hinckley, J.D. Hines, R.E. Hunt, K.R. Kahn, R.W. Klofkorn, T.B. Kulb, I.G. Kuperschmit, J.P. Lucas, D.J. Lynn, G. Mara, D. Martin, M.O. Murphy, M.A. Paske, H.A. Pincus, F.B. Purvis, B.S. Reed, R.F. Schillaci, T.A. Schultz, G.M. Shumaik, S.M. Steele, Jr., H.J. Steinfeld, T.E. Walsh, C.J. Winfrey
Assistant Professorial Lecturers M.N. Hamm, J.K. Miller, S.E.H. Raviv
Instructor J.J. Reich
Adjunct Instructors D.C. Bailey, I.S. Bloom, P.S. Chamberlain, C. Dunbar, J.L. Garber, J.E.S. Goldberg, J.F. Hammer, J.W. Hammond III, K.R. Harbert, N.M. Hoover, E.S. Koenig, G.L. Rebholz, V.R. Reublinger, R.P. Smock, D.T. Wallace
Clinical Instructors D.T. Chua, N.T. Connally, G.A. Logsdon, R.W. Morris, J.A. Noronha, J.C. Noyes
Special Lecturers S.C. Beuttel, L. Brodie, G.W. Dumas, H.B. Firestone, D.L. Gilligan, T.J. Halloran, R.L. Keller-Homayssi, J.B. Laskowski, F.K. Lauber, E.E. Leclerc, M.D. Lieberman, J.L. McDonald, S.C. Miller, H.L. Parlette III, A.E. Randall, L.J. Rice, D.S. Richardson, F.P. Scazzafavo, E.E. Taylor, K.L. Thomas, D.H. Thompson

Courses numbered from 10 through 96 are limited to military personnel in off-campus health sciences programs.

10 **Anatomy and Physiology** (2) Staff
(Formerly 3 credits)
Study of the human body: esteology, arthrology, myology, hematology, immunology; circulatory, respiratory, digestive, endocrine, excretory, nervous, and reproductive systems.

11 **Applied Anatomy and Physiology** (4) Staff
(Formerly 6 credits)
Application of anatomical and physiological principles. Control of hemorrhage, methods of resuscitation, management of shock, relief of pain; physical examination, nutrition, fluid and electrolyte balance, respiratory conditions, childbirth.

15 **Pharmacology and Toxicology** (5)
Medicinal substances used in treating people: pharmaceutical mat
matics, terminology, preparations, compounding, physiological action
potential toxic reactions of certain drugs, legal aspects of drug regulat

16 **Clinical Laboratory Techniques and Procedures** (3)
Laboratory procedures used in basic health maintenance. Use of
croscope, complete blood count, acid-fast stain, urinalysis, blood
mentation rate, RPR card test, coagulation and bleeding time,
grouping, blood typing.

22 **Introduction to Epidemiology** (2)
Study of common communicable diseases, immunologic factors, and
cedures. Contact interviewing and reporting of the communicable disease

67 **Disaster Sanitation** (2)
Survey of nuclear, biological, and chemical hazards; emphasis on
tion, personnel protection, and related functions.

68 **Environmental Sanitation** (3)
Study of certain environmental factors which contribute to human
Food, water, living and working spaces, economics, and pest control

92 **Medical Material Management** (3)
Material management in the medical facility. Budget and
process, expense operating budget, purchasing, material receipt and
spection, inventory of equipment and supplies, controlled
stock record cards, surveys and adjustments, classes of plant
property accountability, storage requirements.

93 **Health Systems Administration I** (3)
(Formerly 4 credits)
Health systems organization. General office procedures,
methods, standard subject identification codes, filing procedures,
disposal, security of patient information, correspondence,
manuals.

94 **Health Systems Administration II** (4)
Planning office systems, procedures, environment, and location.
control, work measurement methods, authority and organizational
tionships, principles of office organization, employee supervision.

95 **Records Management** (6)
Public health records management. Classification of personnel,
records, promotions, educational services, career development,
orientation, medical care eligibility, patient data systems,
analysis.

96 **Clinical Experience** (10)
Supervised experience and research. Application of principles learned
didactic experience to the practical situation.

101 **Environmental Biostatistics** (3)
Statistical reasoning, collection of data, rates, incidence, and
Generalization of observations and use of measurement data. For
campus students.

102 **Food and Water Sanitation** (4)
General characteristics of urban and rural water systems,
distribution, public bathing place sanitation, design and
water treatment facilities. Dairy products and food sanitation.
storing, and distributing food. Supervision and training of food
personnel.

109 **Human Behavior I** (2)
Prepares student to enter clinical work with a practical knowledge
psychiatry. Mental status examination as a tool of clinical

Development of a basic approach to understanding and working with psychiatric patients. (Fall)

111 **Anatomy and Physiology** (4) Staff
Combined course of Anat 115 and Phyl 111. For off-campus students.

113 **Physician Assistant Seminar II** (2) Staff
(Formerly 1 credit)
PA Seminar II focuses on psychosocial issues which will affect the student as a physician assistant, including abortion, depression, patient education, suicide, stress, and crisis intervention. Reviews such issues as certification, professional practice, legislation, reimbursement, and malpractice. Prerequisite: HCS 119. (Spring)

116 **Medical Terminology** (0) Davies
Autotutorial completed before entering Program. Terminology and vocabulary basic to all areas of medical science, hospital service, and allied health specialties.

119 **Physician Assistant Seminar I** (arr.) Staff
Facilitates student's development in the role of physician assistant. Encourages development of communication skills necessary to enhance the humanistic practice of medicine.

120 **Biochemistry for Allied Health Sciences** (2) Staff
See Bioc 111. For off-campus students.

122 **Public Health Microbiology** (3)
General applied concepts of microbiology, fundamental immunologic concepts, general principles of virology, development of a surveillance protocol for nosocomial infection. For off-campus students.

125 **Manifestations of Disease** (arr.) Staff
Interdisciplinary course which presents the theory of medicine using an organ system approach. Presents clinical findings and pathophysiology for a wide spectrum of diseases. Medical and surgical subspecialties present state-of-the-art information on the diagnosis and management of diseases. Prerequisite: HCS 110, 112; Phyl 111.

126 **Clinical Approach to Diagnosis** (arr.) Staff
Equips the student with the basic skills necessary to recognize clinical symptons and signs needed to arrive at an informed provisional diagnosis. For off-campus students.

127 **Clinical Medicine I** (arr.) Staff
Provides the student with an introduction to the recognition of the clinical disease state. An intradisciplinary format allows the student to integrate learning through the use of acquired knowledge in the basic sciences. For off-campus students.

128 **Clinical Medicine II** (arr.) Staff
Continuation of Clinical Medicine I with emphasis on advanced technology used in diagnosis and complete review of the therapeutic approach. Prerequisite: HCS 127. For off-campus students.

131 **Human Behavior II** (2) Staff
Continuation of HCS 109. Prerequisite: HCS 109. (Spring)

133 **Introduction to Clinical Assessment** (arr.) Staff
Clinical interviewing and physical examination. Designed to permit the student to achieve a beginner's level of clinical competence. For off-campus students.

134 **Clinical Assessment** (arr.) Staff
Provides the student with the necessary information and opportunity to refine and practice skills in patient interviewing and physical examination. Provides the student with the abilities necessary to integrate data ob-

tained from the newer and more sophisticated modes of diagnostic tec-
nology. (Fall)

137 **Issues in Health Care** (1) Staf
Focuses on the interface between the individual practitioner-patient inte
action and the various forces of society which have a major impact
the practitioner and the patient. The contribution of law, ethics, eco
nomics, and government to the health care system will be introduced
lectures and panel discussions and illustrated with case reports. For
campus students.

140 **Clinical-Pathological Correlation** (2) Staf
Introduction to medical problem solving via case presentations. Studen
learns to correlate pathophysiology with symptom manifestation. Th
course emphasizes interpretation of historical and physical findings
laboratory data, and radiographic studies pertinent to the disease unde
discussion and examines the rationale for particular drug therapies,
cluding an understanding of side-effects and dosage selection. Prerequisi
HCS 116.

142 **Nurse Practitioner Seminar I** (3) Johnson
(Formerly 2 credits)
Role resocialization and current issues influencing development of the
nurse practitioner role. History-taking and communication skills are
major focus.

143 **Nurse Practitioner Seminar II** (3) Johnson
(Formerly 2 credits)
Continuation of HCS 142.

144 **Nurse Practitioner Seminar III** (3) Johnson
(Formerly 2 credits)
Continuation of HCS 142 and 143.

145 **Primary Care and Therapeutics** (2) Staf
Introduction to problem solving, management, and treatment of primary
care problems in adult medicine. Case presentations are used, as well as
weekly presentations of relevant articles researched by the student.

146 **Emergency Medical Techniques** (1) Staf
(Formerly Surgical and Diagnostic Procedures)
Students learn the principles of recognizing, evaluating, and treating the
patient with an urgent or emergent problem. Review of signs and symp
toms, accompanying physical findings and methods for diagnosis and
treatment of a spectrum of emergent illnesses. The laboratory portion of
the course prepares students for the clinical skills or procedures they will
perform in their clinical year, including suturing, gowning and gloving,
CPR and ACLS certification, cast application, intubation, and catheteriza
tion.

147 **Introduction to Radiology** (1) Staf
Emphasizes principles and language of radiologic imaging, as well as
radiologic anatomy. Students begin to develop a systematic approach to
radiology and an ability to distinguish normal from abnormal radio
logical findings.

148 **Introduction to Electrocardiography** (1) Staf
Fundamentals of electrocardiography and interpretation of basic ECG
patterns are stressed. Common errors in taking and reading ECGs are
examined. The identification of common normal and abnormal wave
patterns is emphasized by reviewing ECGs taken by the students and
others. Information about the effects of drugs and electrolyte imbalance
on ECG patterns.

151 **Clinical Pharmacology** (arr.) **Staff**
Therapeutics presents day-to-day clinical situations for discussion of the appropriate use of medication and various treatment modalities. Dosages, actions, routes of administration, indications, and contraindications are covered. Advantages, disadvantages, and reasons for selecting the drug of choice or an alternative are stressed.

153 **Gynecology Outpatient: Nurse Practitioner** (arr.) Staff
Required rotation for nurse practitioner students. Management of gynecological problems in ambulatory setting.

154 **Clinical Geriatrics** (arr.) **Johnson**
(Formerly Geriatric Practicum)
Required rotation for nurse practitioner students. With guidance and approval of advisor, students develop individual study and learning objectives.

157 **Primary Care Preceptorship: Nurse Practitioner** (arr.) **Staff**
Six-week required rotation for nurse practitioner students. All aspects of patient management in ambulatory setting.

160 **Medical Inpatient** (5) **Staff**
Six-week rotation in which the student learns to recognize, collect, and integrate information regarding the medical problems of a patient who has been admitted to the hospital. The student is part of a medical team under the supervision of the medical resident or attending physician. Students are on a regular call status. Attendance is required at all work rounds, lectures, and conferences.

163 **Medical Outpatient** (arr.) **Staff**
Six-week rotation in which the student learns to recognize, collect, and integrate information regarding the various medical problems encountered in the ambulatory setting. Takes place in a primary care setting such as an outpatient clinic, an HMO, or a community health center. Emphasis on differential diagnosis, patient management, and preventive medicine. Students function as part of the health care team under physician supervision.

165 **Medical Outpatient: Nurse Practitioner** (arr.) **Staff**
Rotation for nurse practitioner students, arranged with approval of advisor. Aspects of specialty patient management in ambulatory setting.

166 **Surgical Inpatient** (5) **Staff**
Six-week rotation in which the student learns to recognize, collect, and integrate information relating to the admitted surgical patient. In-depth experience in the pre- and post-operative management of the surgical patient. Students assist during operative and ward procedures and function as part of the surgical team under a physician's supervision.

167 **Surgical and Emergency Medicine** (arr.) **Staff**
Same as HCS 178 except that length of course is variable. For off-campus students.

169 **Obstetrics and Gynecology** (arr.) **Staff**
Six-week rotation in which the student learns to recognize, collect, and integrate information regarding the obstetrical and gynecological patient. Exposure to outpatient gynecological problems and inpatient obstetrical practice. Students act as part of the obstetrical/gynecological health care team under physician supervision.

170 **Obstetrics and Gynecology: Nurse Practitioner** (arr.) **Staff**
Two-week elective rotation for nurse practitioner students. With guidance and approval of advisor, students develop individual study and learning objectives.

171 **Pediatric Outpatient: Nurse Practitioner** (arr.)
Elective rotation for nurse practitioner students. Ambulatory pediatric practice.

172 **Pediatric Outpatient** (arr.)
Six-week rotation in which the student learns to recognize, collect, and integrate information regarding the medical problems of the pediatric outpatient. Takes place in a pediatric ambulatory setting under the direction of a pediatrician. Normal growth and development, pediatric history and physical examination, and management of common pediatric illnesses are some of the selected topics.

174 **Primary Care** (5)
Required rotation for off-campus allied health students. All aspects of primary care medicine. Hospital rounds with attending physicians.

175 **Primary Care Preceptorship** (arr.)
Eight-week experience in which the student performs much as a graduate physician assistant in a primary care setting. Appropriate primary care areas include pediatrics, internal medicine, family practice, and emergency medicine.

178 **Emergency Medicine** (5)
Six-week rotation in which the student learns to recognize, collect, and integrate information regarding the emergency patient. Takes place in an emergency room department in which the student is exposed to a variety of emergency situations through rotating shifts. The student performs as part of the emergency medical team under the supervision of an emergency room physician.

179 **Emergency Medicine: Nurse Practitioner** (arr.)
Rotation for nurse practitioner students. Medical and surgical emergency management problems.

180 **Practicum in Environmental Health** (10)
Supervised fieldwork. Food service, housing, water, sewage and solid waste, and infectious diseases. Occupational health problems. Reports and conferences.

181–82 **Introduction to Environmental Science** (3–3)
Water: general characteristics (urban and rural), treatment and distribution, public bathing place sanitation, design and function of water treatment facilities. Recognition and control of environmental pollution. Treatment and disposal of human wastes. Food sanitation: processing, storage and distribution. Effects of major pollutants on people. Radiological safety. For off-campus students.

183 **Introduction to Industrial Hygiene** (3)
Chemical hazards: diseases caused by chemical exposure, toxic dust, metal fumes and vapor, gases and organic compounds. Physical hazards: biological effects of low and high temperatures, radiation (electromagnetic, ultraviolet, ionizing), illumination, sound, pressure and atmospheric pollution. For off-campus students.

184 **Public Health Organization and Administration** (3)
Public health activities and organization, philosophy, background, and development. Vital statistics, laboratory services, education, nursing, and social services. Administrative considerations, including governmental aspects, fiscal management, personnel factors, and public relations in public health organizations. For off-campus students.

185 **Environmental Impact and the Law** (3)
The rationale for environmental impact statements from the viewpoint of the nature and origins of the environmental crisis. Government agencies

responsible for environmental impact statements, current statutes and regulations pertaining to the environment. For off-campus students.

190 **Dermatology** (1)
Clinical assessment of common dermatologic conditions found in the ambulatory care setting. For off-campus students.

191 **Eye, Ear, Nose, and Throat** (3)
Diagnostic and therapeutic approaches to determining the outcomes of disease of the eyes, ears, nose, and throat. For off-campus students.

192 **Orthopaedics** (3)
Diagnosis and treatment of common orthopaedic problems found in the primary care setting. For off-campus students.

194 **Practicum in Gerontology and Geriatric Care** (arr.) Staff
Supervised fieldwork with the elderly or in administration and planning for the elderly. Offered in cooperation with other schools and departments of the University. For medical students and for undergraduate and graduate students in the social sciences and Health Services Administration.

196 **Issues in American Health Care** (arr.) Povar
Fieldwork combined with academic study of the present American health care system and its problems: cost, quality of care, delivery of care, ethical issues, health education, consumer issues. Field placements (12–20 hours per week) in appropriate health-related activities. Admission by permission of instructor. Undergraduate students only. (Fall and spring)

197 **Current Topics in Bioethics** (1) Povar
Critical investigation of various areas of bioethics. Designed and presented by an all-campus faculty group that includes physicians, lawyers, economists, philosophers, and health care administrators.

198 **Psychiatry** (arr.) Staff
Six-week rotation in which the student learns to recognize, collect, and integrate information regarding the psychiatric patient. The student is part of the therapeutic community and is exposed to the identification, treatment, and therapy of the psychiatric patient.

199 **Independent Study** (arr.) Staff
Required rotation in which the student determines the area of study with the approval of the faculty. Students are expected to develop learning objectives in conjunction with their faculty advisors. Evaluation of the student is based on completion of the learning objectives.

201 **Practicum in Geriatric Care** (1) Boren, Pawlson
Clinical experience will include interviewing elderly persons (the initial assessment), observation of medical history taking and physical assessment, and participation in a multidisciplinary case conference. (Fall and spring)

202 **Take Care of Yourself** (1) Boren, Snodgrass
Interdisciplinary field experience working with the elderly. Weekly 1-hour seminars provide background for teams of medical and HKLS students to conduct classes at community-based settings which focus on health education, physical fitness, dance/exercise, and methods of self-care. Students act as health advocates, aiming to foster improved physical, social, and emotional health for elderly persons. Students keep a record of activities and are required to submit a written report on their experience. (Fall and spring)

230 **Emergency Medicine I** (2)
Required course for first-year medical students. Didactic presentations guest speakers on general principles in the pre-hospital care and hand of victims of accident and illness. Emphasis on pre-hospital manage of typical emergencies. Patient assessment, cardio-pulmonary resusc tion, bandaging and splinting, lifts and carries, intravenous therapy a parenteral drug administration. Opportunities to practice psychom skills and rescue techniques during regularly scheduled practicum s sions. (Spring)

231 **Emergency Medicine II** (1)
Elective continuation of HCS 230. The student is expected to develop p ficiency equivalent to that of an emergency medical technician. Oppo nities to spend time in the University Emergency Room and ride on a a basic life support ambulance or mobile intensive care unit with the structor. After successful completion of Emergency Medicine I and II student is awarded an Emergency Medical Technician certificate by University.

232 **Studying a Study: Methods for Reading the Medical Literature** (1) Riegelman
Required course for first-year medical students. Principles of analyzing medical journal articles with application to actual clinical articles. Le tures and seminars stress non-mathematic epidemiology and biostatistics principles with multiple illustrations of errors which can occur in resear articles. Staff

301 **Clerkship in Primary Care** (10)
Required for third-year medical students. Care of patients in ambulatory setting. Includes participation in University's prepaid health plan (HMO) emergency room, and office practice of general internists, general pediatr cians, and family practitioners. Emphasis on specialty skills which contrib ute to physician's capacity to care for common minor illnesses. Office practice of orthopaedics, otolaryngology, dermatology, and ophthalmology. Participation with District of Columbia Fire Department in responding to ambulance calls. Lecture series provides foundation for office management of common illnesses in ambulatory setting. 8-week elective periods throughout the academic year. Pawlson

350 **Ambulatory Health Care** (5)
Research or clinical experience in primary medical care, including geri atric medicine. Participation in project relating to health care delivery, including medical audit, study of organization of health services, and problems of underserved (especially elderly) populations. Clinical ex perience will be arranged. Exchange with similar program in other in stitutions is possible, especially for those participating in model family practice units. 4-week elective periods.

351 **Biomedical Ethics** (5) Lynn and Associated Faculty
For senior medical students at Georgetown, Howard, Uniformed Services and GWU. Subjects will be chosen from areas of current concern for the medical professions, including definition of health and disease, delinea ation of physician and patient role, research issues, especially the require ment for consent, choices in the allocation of scarce resources, health care systems organization and alternatives such as national health insur ance, and rights of patients and providers. Aspects of history, law, eco nomics, and sociology will be included. 4-week elective periods (Spring)

359 **Emergency Health Care** (5) Shesser
Rotation in emergency medicine offered by the Division of Emergency Medicine. Supervision by the division's full-time faculty and house staff rotating through the division. Approximately 48 hours per week, with some night call. 4-week elective periods. GWU Hosp.

360 **Emergency Health Care** (5) Shesser
Assignment to the Washington Hospital Center emergency room. Instruction by full-time and resident emergency room staff. Cardiopulmonary resuscitation and management of trauma, drug overdose, coma, and common illnesses and injuries in emergency care setting. 4-week elective periods.

361 **Family Practice Preceptorship** (5) Pawlson
Students spend four to eight weeks in a family practice preceptorship in rural Garrett County, Maryland. Supervision is by board-certified family practitioners in the Garrett County Medical Center. The physicians are affiliated with the University of Maryland Family Practice Program of which this site is a part.

362 **Rural Family Practice Preceptorship** (5) Pawlson
Family health care in a small coal mining town in central West Virginia. The Somersville Hospital Family Practice Center includes facilities for outpatient, inpatient, and emergency services. Supervision is by three board-certified family practitioners. 4-week elective periods.

363 **Geriatric Medicine** (5) Pawlson
Clinical experience at congregate housing facility, outpatient practice, hospital home visits, and long-term care facility; opportunity to supplement experience with activity at senior centers and day care facilities. 4-week elective periods.

369 **Issues in Health Care** (1) Povar
Overview of important issues in health care. Lectures focus on broad issues, such as the organization of health care and the role of different professions in the U.S., and on the individual concerns of the patient. Course explores the patient-practitioner relationship as well as the legal and ethical problems of medical practice. Individual and group projects, seminar discussions, and panel presentations by patients. Required for second-year medical students. (Fall)

370 **Mental Health Provision in the Primary Care Setting** (5) Shaffer
For senior medical students who seek clinical experience in a multi-disciplinary mental health practice, with emphasis on the short-term treatment of patients commonly presenting in a primary care setting. Students are exposed to such problems as sexual dysfunction, depression, and psychosomatic symptoms as they are presented in an ambulatory care setting. The student is given the opportunity to perform initial evaluations, observe groups, follow patients, and provide consultation to primary care teams. Limited to one student per session for a minimum 6-week elective period.

389 **Elective in Emergency Medicine** (5) Shesser
One-month rotation in emergency medicine offered by the Division of Emergency Medicine at the George Washington University Hospital's Emergency Department. Supervision is provided by the Division's full-time faculty and house staff rotating through the Division. Hours will be approximately 48 hours per week with some night call.

390 **Extramural Health Care Sciences Elective** (ARR.)
The department makes arrangements for students to spend one or more elective periods at other institutions. Approval of the department chairman required.

Interdisciplinary Courses

First-year medical students are required to take Idis 212, *Neurobiology*, administered by the Departments of Anatomy and Physiology. Staff

212 **Neurobiology (3)**
Same as Anat 212 and Phyl 212. Integrated survey of the structure and function of the human nervous system; lecture, clinical demonstration and laboratory.

Introduction to Clinical Sciences, an interdisciplinary program, is required of medical students in the second year. By means of lectures, panel discussions, seminars, case presentations, demonstrations, and examinations of patients, it provides students with basic instruction in various clinical subjects and prepares them professionally and personally for the clinical clerkships and career electives in the third and fourth years. The program is under the direction of a Coordinating Committee appointed by the Dean for Academic Affairs of the School of Medicine and Health Sciences and formulated by the Second Year Subcommittee of the Educational Planning Committee. The Coordinating Committee consists of representatives from the departments responsible for teaching courses in the program and medical students: Melissa Perkal, second-year student; Jerry M. Wiener, Department of Psychiatry and Behavioral Sciences; Deborah Day, third-year student; Frank Miller, Department of Pathology; Gail Povar, Department of Health Care Sciences; Thomas Piemme, Department of Medicine (Chairman of the Coordinating Committee); John C. LaRosa, Department of Medicine; Samuel Scott, Department of Medicine; Rhonda Goldberg, Office of Education; and James Straw, Department of Pharmacology. In addition to Idis 301 (see below), the program consists of Path 201, Phar 202, HCS 137, and Pschi 201. Staff

301 **Introduction to Clinical Medicine (16)**
One-year course. Integrated, organ-oriented course, with an emphasis on physical diagnosis. Fundamental instruction in child health and development, clinical problem solving, dermatology, gynecology, internal medicine (including subspecialties), neurology, obstetrics, ophthalmology, psychiatry, radiology, and urology; hospital-based physical diagnosis and history-taking experience.

Medical and Public Affairs

Chairman: M. Head

Professors M. Head, D.J. Sharpe, E. Waters, Jr. *(Research)*
Associate Professor F.J. Kavanaugh *(Research)*

351 **Law and Medicine** (2) Sharpe, Head, Fischer
Open to second-year medical students. Problems arising when the professional interests of lawyers and physicians overlap. Malpractice, personal injury litigation, licensure and discipline, ethics and economics, hospitals and other institutions, and compelled treatment. (Spring)

Medicine

Chairman: J.C. Rios

Directors of Divisions: A.M. Ross *(Cardiology)*, A.L. Ginsberg *(Gastroenterology)*, L.S. Lessin *(Hematology-Oncology)*, C.U. Tuazon *(Infectious Diseases)*, K.L. Becker *(Metabolic and Endocrine Diseases)*, S.V. Spagnolo *(Pulmonary Diseases and Allergy)*, I.G. Tamagna *(Rehabilitation Medicine)*, A.M. Thompson *(Renal Diseases)*, R.P. Jacobs *(Rheumatology)*

Professors J.M. Bacos, W.P. Baker, W.F. Barth, K.L. Becker, D.O. Castell, T.O. Cheng, J.A. Curtin, V.T. De Vita, M.L. Elgart, G.D. Eng, J.M. Evans, W.R. Felts, Jr., J.D. Finkelstein, W.P. Fortune, D.E. Hawkins, A.C. Hollinshead *(Research)*, I.I. Hsu, R.P. Kaufman, R.I. Keimowitz, P.D. Kind, N.C. Kramer, J.C. LaRosa, F. Leonard *(Research)*, L.S. Lessin, J. Lindsay, Jr., E. Mikulac *(Visiting)*, D.S. O'Leary, A.E. Parrish, T.E. Piemme, L.E. Pierce, H.V. Pipberger, H.E. Ratcliffe, R.C. Reba, D. Reiss, J.C. Rios, M.J. Romansky, A.M. Ross, G.P. Schechter, E.R. Simon, S.V. Spagnolo, I.G. Tamagna, C.U. Tuazon, P.J. Varghese, D.M. Watkin *(Research)*, P. Witorsch, F.W. Wolff, H.J. Zimmerman

Adjunct Professor W.D. Denckla

Clinical Professors E. Adelson, A. Baer, W.H. Crosby, S.H. Danovitch, H.D. Ecker, F.A. Ennis, M. Fuchs, M. Gusack, H.L. Kamenetz, G.A. Kelser, Jr., S.D. Loube, F.J. Murray, B. Nelson, E.P. Parker III, J.J. Rheingold, A.B. Rosenbaum, T.S. Sappington, R. Scalettar, H.M. Silver, M.H. Stolar, C.W. Thompson, N.P. Trujillo, M.S. Wolfe

Professorial Lecturers D.S. Fredrickson, H.A. McAllister, W.C. Roberts, S.G. Sandler

Associate Professors O. Alabaster, M. Braun III, W.S. Chiu, M.H. Cohen, P. Cohen, D.W. Dew *(Research)*, K.J. Dickie, B.E. Fossieck, Jr., B.L. Frankel, J.H. Gaskin, A.L. Ginsberg, M.S. Gold, P.A. Gorman, R.P. Jacobs, P.P. Klug, R.F. Levine, C.W. Linebaugh, K. Mallik *(Research)*, J.M.B. O'Connell, L.G. Pawlson, V.A. Portnoi, S.J. Scott, Jr., W.H. Scott, O.L. Silva, A.W. Stone, A.M.S. Thompson, G.R. Werth, K. Wipplinger

Adjunct Associate Professors N.L.H. Gerber, E.A. Jones, W.W. Karney, K.M. Kent, J.S. MacDonald

Associate Clinical Professors B. Arling, W.O. Bailey, Jr., L.F. Barker, S.E. Barr, G.S. Belaval, R.B. Benedict, W.D. Brill, J.B. Calatayud, P.P.L. Chang, A.W. Danish, O.W. Donnelly, D. Ein, M. Enders, R. Evans III, J. Fenton, R.A. Fischer, B.J. Gershen, K. Goldstein, R.A. Goldstein, A. Guha, R. Haider, B.A. Heckman, M. Hershkowitz, P.V. Holland, W.S. Hughes, M.H. Jacobson, C.W. Jones, J.A. Kark, R.M. Kaufman, J.D.B. King, J. Kleh, A.A. Lear, A.G. Levy, J.F. Mermel, J.F. Meyer, H.S. Mirsky, A.M. Mondzac, H.A. Moscovitz, G.H. Nachnani, M.A. Newman, D.A. O'Kieffe, J.M. Pisani, J.S. Putnam, D.R. Rosing, C. Rudzki, A. Ruskin, H.C. Sadin, R.K. Sarin, P. Schlein, C.A. Schulman, S.F. Seides, A. Seltzer, J.R. Shapiro, D.B. Simon, B. Slosberg, R.B.W. Smith, H.L. Smits, M.J. Stern, S.J. Talpers, L.J. Thomas, I.N. Tublin, H. Weiss, L.M. Weiss, E.E. Westura, R.S. Wilkinson, L.A. Wisneski, S.J. Wolin, D. Yoo

Assistant Professors A.N. Amigable, A.A. Arabian, J. Ardizonne, B.C. Blair, L.D. Bohan, D.G. Borenstein, F.H. Corcoran, C.J. Davis, K.K. Davis, M.D. Delaney, S. Dosa, M.J. Drass, R.A. Ferreras, D.E. Fleischer, E.C. Flores, D.F. Fragnul, H.N. Friedman, A.G.S. Fry *(Research)*, B.J. Gaffney, D.B. Gail *(Research)*, B.N. Garrett, L.P. Georges, H.D. Goldstein, R.J. Katz, C.A. Kramer, W. Kurland, T.V. Kuzmowych, R.H. Leiboff, C.S. Levy, J.H. Lewis, A.E. Medinger, S.H. Mendelson, J.M. Mitchell, R.A. Muenz *(Research)*, E. Perlin, L.H. Pierce, Jr., G.J. Povar, R.K. Riegelman, R.G. Robinson, P.K. Rohatgi, L.P. Saladino, R.C. Saunders, R.S. Schulof, R.F. Shesser, G.L. Simon, M.S. Smith, L.F. Sorkin, C.T. Spiegel, W.M. Steinberg, L.E. Swanberg, Z.M. Tape, R.J. Warchol, A.G. Wasserman, P.H. White

Adjunct Assistant Professors C.M. Kessler, B.R. Kressel, C.J. Shuman

Assistant Clinical Professors C.B. Abrams, I.H. Ardam, P. Assatourians, S.M. Babin, H.S.B. Baraf, E.A. Beeman, L.F. Bentolila, R.A. Berenson, S.H. Berk, L.H. Biben, C.J. Bier, B.L. Burka, H.D. Capone, K.H. Chase, M.R. Chasse, B.I. Choi, F. Chucker, M.I. Cinnamon, R.F. Cioffi, N.B. Cirillo, B.S. Cooper, R. Copperman, N.A. Crane, J. Crowell, G.B. Cushner, R.A. Di Giulio, D.B. Doman, T.P. Dwyer, R.F. Dyer, G.T. Economos, D.S. Edge, W.K. Ehrmantraut, N.E.S. Falk, M.H.W. Fang, L.H. Fenton, S.M. Fidler, A. Frank, S.B. Fredd, A.A. Friedman, D.B. Goldberg, S.G. Goldberger, H.S. Goldstein, W.Y.K. Goo, D.H. Goodman, L.D. Green, R.E. Greenspan, A.H. Grollman, P.A. Haber, J.T. Hagenbucher, D.J. Hand, F.K. Harris II, T.L. Hartman, W.H. Harvey, M.A. Herman, S.H. Houseman, S.K. Irani, M. Katikineni, H.I. Katzen, N. Kirmani, B. Kotelanski, W. Kurstin, H.M. Lando, J.A. Lang, P.C. Latkin, S.D. Lerner, P.H. Levine, A. Lipson, J.W. Long, J.P. Lucas, D.J. Lynn, D.C. Marcus, R.A. McConnaughy, B.A. Meyers, F. Meyers, V.T. Miller, J.C. Mulhauser, R.A. Nicklas, A.A. Nimeh, R.A. Noble, A.A. Oboler, J.A. Ocuin, G.M. Orr, R.J. Osheroff, B.H. Ostrow, N.S. Otchin, S.W. Park, M.A. Parker, M.M. Phillips, G.N. Polis, P.W. Post, D. Ramaswamy, J.N. Ramey, S.N. Richman, D.N. Robins, J.D. Robinson, M.H. Rose, J. Rosenberg, A. Rotsztain, N.H. Rubenstein, F.M. Ryan, T.L. Sacks, M. Schneider, R. Schoenfeld, S.A. Schwartz, A. Segal, P.M. Seltzer, J.C. Seymour, A.B. Shauer, M.M. Shefferman, P.B. Sherer, B.E. Sherwin, T.G. Sinderson, M.A. Sislen, J.T. Solano, I. Spector, M. Stock, L.O. Sullivan, J.M. Taubin, D.H. Waterman, J.H. Weiner, I. Weiszer, A.L.B. Williams, **K.Y. Yeung**

Clinical Instructors E. Aleskow, H.J. Alpert, O.M. Applewhaite, C.L. Bender, M.R. Capon, T.H. Clark, N.T. Connally, R.L. Ellis, N. Gonzalez, H. Gordon, S.L. Horwitz, J.P. Kalman, M.A. Kavalier, M.R. Kendall, R. Kramer, A.S.T. Lai, S. Leibenhaut, N.A. Lieberman, I.V. Magal, N. Mendjuk, D.E. Millon, M. Nemati, S.R. Rishi, L. Ruckstuhl, H.A. Schumann, P.S. Spiegler, **R.S. Waldman, M.T. Wallace, L.M. Weinberg**

Special Lecturer **S. Katz**

201 **Diagnostic Studies in Clinical Medicine** (1)
Combination of didactic sessions concerning physiopathology and its relation to laboratory studies, practical sessions, and case problems they relate to the utilization of laboratory and other diagnostic dures, with emphasis on decision making. Second-year students only.

250 **Introduction to Occupational and Environmental Medicine** (2) — Chase

Health effects of various occupational and environmental hazards and pollutants discussed from several perspectives, including basic research, federal regulation, labor/management, and the physician. Health effects of radiation, air and water pollution, toxic substances, and environmental extremes. Limited enrollment.

*305 **Inpatient Clerkship** (10) — Staff

Comprehensive study of patients; history and physical examination; ward rounds, consultations, conferences, preceptorial teaching, seminars. V.A. and Univ. Hosps., and Wash. Hosp. Center. (8-week periods throughout academic year)

331 **Acting Internship in Medicine (Hematology-Oncology)** (5) — LaRosa

Assignment to a ward team dealing exclusively with patients with oncologic problems. Many patients will be on chemotherapy protocols and all will be seriously ill and in need of considerable special attention. Special conferences and regular house staff conferences. Students will take night call with the ward team and will be expected to function at the level of interns on the team. 4-week periods. Univ. Hosp.

332 **Acting Internship in Medicine** (5) — LaRosa

Responsibility at the intern level. Initial patient evaluation and diagnostic and therapeutic plans, writing all medical orders (which must be countersigned by an M.D.), coordinating patients' care, writing progress notes, and dictating the discharge summary. Night call with the ward team. House staff conferences. 4-week periods.

333 **Acting Intern in Medicine** (5) — Curtin

Under the supervision of the medical resident and attending physician, student works with a patient-care team on a medical ward, does initial evaluation, and presents patient's problem at attending rounds and appropriate teaching conferences. Subspecialty consultations also review patient's problem with the student. 4-week elective periods. Wash. Hosp. Center.

334 **Acting Intern in Medicine** (5) — Finkelstein

Students assigned to a patient-care team under direct supervision of a University resident on general medical wards. Problem Oriented Medical Record System used. Students complete initial patient evaluation data base and are responsible for clinical management during hospitalization. They write all orders, which must be reviewed and cosigned by the resident, and are expected to present their patients at attending rounds and conferences. Close supervision and guidance by the team resident, attending physician, and subspecialty consultants. Interview required. 4-week elective periods. V.A. Hosp.

335 **Acting Intern in Medicine** (5) — Wisneski

Responsibilities of intern. Similar to Med 332. 4-week elective periods. Holy Cross Hosp.

336 **Intensive Care Medicine** (5) — Witorsch

4-week elective periods. Wash. Hosp. Center.

338 **Occupational and Environmental Medicine** (5) — Chase

Students select a field setting in Washington area (AMTRAK, EPA, DC Fire/Police Depts., Navy Diving School, etc.) in which the effects of various occupational and environmental health hazards are addressed. Participation in administrative and clinical intervention is provided under direct

* Required for medical students.

physician's supervision. Emphasis on the relationship of occupational an environmental medicine to the practice of primary care. Travel oppor tunity to distant field sites is generally available. 4-week elective periods.

349 Infectious Diseases (5) Curtin and Lev

Clinical experience in infectious disease service. Daily work rounds in cluding lab, conferences, Journal Club. 4-week elective periods. Wad Hosp. Center.

350 Clinical Infectious Diseases (5) Parke

Introduction to the diagnosis and treatment of bacterial, viral, fungal, and mycobacterial infections. Students assume primary responsibility for in fectious disease consultations in conjunction with Fellows, residents, and full-time faculty members. Clinical application of laboratory techniques used in the diagnosis and treatment of patients with infectious disease problems. Emphasis on the usefulness of rapid diagnostic techniques and pharmacology of antimicrobics. Students will participate fully in all the section's activities. 4-week elective periods. V.A. Hosp.

351 Clinical Infectious Diseases (5) Tuazo

Clinically relevant aspects of microbiology and immunology; relevant aspects of patient history, physical and laboratory examinations. Students will learn to do infectious disease consultations and to use antibiotics in telligently. Minimum 4-week clinical rotation. Students electing a longer time period will assist with research project in infections in drug abusers, staphylococcal infections (especially endocarditis), clinical pharmacology of gentamicin or mechanisms of immunity in sickle cell anemia patients. Univ. Clinic.

352 Clinical Cardiology (5) Hsu and Staff

Designed to provide experience in ambulatory and hospitalized patient care, ECGs, graphics, CCU, exercise lab; observation in cath. lab. 4-week elective periods.

353 Clinical Cardiology (10) Manchester

Observation of and participation in the diagnosis and clinical management of cardiovascular disorders. Acquaintance with physical signs of heart dis ease. Exposure to noninvasive diagnostic procedures, echo-, phono-, angio cardiography; interpretation of electrocardiograms and chest x-rays; ward rounds in intensive coronary care unit. 8-week elective periods. Ross

354 Preceptorship in Cardiology (5)

Placement with practicing cardiologists in office and hospital settings. 4-week elective periods.

355 Intensive Care/Coronary Care/Critical Care (5) Haider and Meyer

Student is assigned to a twelve-bed critical care unit which includes coro onary patients as well as medical-surgical patients with intensive care problems. There is a separate eight-bed intensive care unit. Student works with a senior resident assigned to these units, works up all patients ad mitted to these units, and makes daily rounds with teaching physicians. Student will assist in the care of critically ill patients and those with suspected myocardial infarction or cardiac arrhythmias who need monitoring, electrocardioversion, pacemaker insertion, and Swans Ganz catheter insertion. Student is responsible for all orders under resident and at tending supervision and follows patients as they leave the coronary care intensive care units to intermediate care beds on the second floor. Night call is optional. Haider

356 Cardiovascular Diseases (5)

Assignment to a group of patients with non-emergent cardiac problems and to a resident. Rounds are made three times weekly. Weekly teaching conferences with members of the Cardiology staff. The student will pre-

vide day-to-day care of patients with cardiovascular problems, including hypertension, congestive heart failure, and valvular and pericardial diseases, and will observe diagnostic studies, including exercise stress testing, echocardiography, and electrocardiograph interpretation. 4-week elective periods. Providence Hosp.

358 **Clinical Cardiology—Washington Hospital Center** (5) — Mendelson, Bacos, Lindsay, Goldstein

Active participation in the clinical cardiology service of Washington Hospital Center. Bedside evaluation correlated with electrocardiography and other diagnostic studies, including stress testing, phonocardiography, echocardiography, cardiac catheterization, and nuclide angiography. 4-week elective periods. Wash. Hosp. Center.

359 **Coronary Care Unit—Washington Hospital Center** (5) — Mendelson, Bacos, Lindsay, Goldstein

Active participation in the care of patients on the coronary care unit of Washington Hospital Center. The student works closely with house staff and attending staff. Emphasis on diagnosis and treatment of coronary disease, complications of infarction, diagnosis and treatment of arrhythmias, and selection of patients for surgical intervention. 4-week elective periods. Wash. Hosp. Center.

360 **Clinical Cardiology** (5) — Fletcher*

Experience in clinical cardiovascular problems under supervision of cardiology staff. Emphasis on history, physical diagnosis, and noninvasive cardiovascular techniques. Role of cardiac catheterization explained and results in specific cases discussed. Electrocardiography covered as one of the tools used to approach the cardiovascular patient. Patient management is integral part of course. Teaching rounds and conferences. 4-week elective periods. V.A. Hosp.

361 **Cardiology—NIH** (5) — Rosing

Broad exposure to all aspects of congenital and acquired cardiac disease. Participation in diagnostic and therapeutic work-up of patients and evaluation of acute and long-term effects of medical and surgical interventions. 4-week elective periods.

363 **Cardiac and Medical Intensive Care—V.A. Hospital** (5) — Saunders†

For students interested in acute medicine. Night call every third night. Students participate in all aspects of coronary and medical intensive care, becoming familiar with diagnostic and therapeutic techniques used on this unit: mechanical ventilation, right heart catheterization and central hemodynamic monitoring, temporary pacemakers, intra-aortic balloon counterpulsation, cardiac rhythm monitoring, and new drugs. The student has the opportunity, under close supervision, to manage a spectrum of other non-cardiac medical emergencies. 4-week elective periods.

364 **Cardiovascular Data Processing** (5) — Pipberger

Study of a variety of modern computer techniques; primary research in computer analysis of electrocardiograms. 4-week elective periods. V.A. Hosp.

365 **Clinical Electrocardiography and ECG Computer Analysis** (5 or 10) — Pipberger

Participation in daily computer processing and analysis of electrocardiograms from the V.A. Hospital. ECG findings are correlated with clinical data from all problem cases. Daily review sessions with section chief and

* Dr. Fletcher is Chief of Cardiology at the Veterans Administration Hospital.
† Dr. Saunders is Assistant Chief of Medicine for Intensive Care at the Veterans Administration Hospital.

cardiac fellows. Participation in seminars and a journal club. 4- or 8-week elective periods. V.A. Hosp.

370 **Endocrinology** (5 or 8) El-Hodar

Assignment as an acting intern to work with a second- or third-year resident. Consultations of the general medical service on patients with endocrine problems. Rounds are made on a daily basis, and a weekly teaching conference is held to discuss endocrine problems in depth. Opportunity to attend teaching duties at D.C. General Hospital. In-depth evaluation of patients with endocrine problems, as well as emergency care of patients admitted to medical floors and intensive care unit for serious life-threatening endocrine emergencies. Night call is approximately every third night (optional). 4- or 6-week elective periods.

371 **Endocrinology** (5) Gaski

Student evaluates patients referred to the endocrinology service, takes part in planning diagnostic work-ups and therapy, and is responsible for case presentations and follow-up of those patients. Clinical rounds are held daily, and endocrine clinic and diabetic clinic are held weekly. Weekly endocrine conference includes journal club once a month and pediatric endocrinology once a month. Rounds and conferences at the V.A. and G.W. Hospitals are also included when possible. Assigned reading is reviewed daily. 4-week elective periods.

373 **Endocrinology and Metabolism** (5) Becker

Clinical experience in endocrinology and metabolism. Students examine endocrine patients, make preliminary diagnoses, and assist in treatment. Clinical rounds daily; weekly endocrine clinic, diabetic clinic, and journal club participation; laboratory and research experience available. 4-week elective periods. V.A. Hosp.

375 **Endocrinology Research** (10) Becker and Staff

Participation in endocrinology and metabolism research laboratory. Introduction to chemical and technical aspects of endocrine research. Participation in ongoing research activities. Students learn appropriate procedures, such as radioimmunoassay of hormones, histopathologic techniques, atomic absorption spectrophotometry, and investigative approach to solving research problems. Prior interview with instructor suggested. 8-week elective periods.

376 **Metabolic Disorders in Diabetes** (5) Penhos

Intensive and practical studies of the technique to examine surgical, chemical, and hormonal diabetes. Participation in research on carbohydrate, protein, and lipid metabolism, insulin secretion in isolated organ perfusions. Seminars and participation in journal club; discussions on the results obtained. 4-week elective periods.

381 **Research in Endocrinology** (5) Penhos

Participation in endocrine research, including laboratory experience, experimental surgery, biochemical methods, and *in vivo* and *in vitro* endocrine studies. Weekly seminars and discussions correlate experimental results with clinical observations. 4-week elective periods. V.A. Hosp.

390 **Extramural Internal Medicine Elective** (arr.)

The department will permit students to spend elective periods at other institutions. Interested students should contact the department chairman. Cohen

391 **Clinical Oncology** (5)

Participation in clinical management of patients with carcinoma on the Nat'l Cancer Institute-V.A. Med. Cntr. oncology ward. 4-week elective periods. V.A. Hosp.

393 **Medical Oncology** (10) Young
Current methods of evaluation and treatment of lymphomas, Hodgkin's disease, testicular tumors, ovarian, breast, and other malignancies, including a view of the broad spectrum of these diseases. Participation in patient care and review of clinical trials. Procedures such as bone marrows, liver biopsies, and other staging techniques. 8-week elective periods.

402 **Research in Cancer Immunology** (10) Hollinshead
Laboratory experience with tests used to correlate cellular anti-tumor reactivity to solid tumors with the clinical course of the disease; experiments to investigate viral etiology of certain forms of cancer; study of fetal antigens and role in oncogenesis; cell membrane antigens specific for leukemia. 8-week elective periods. Ross Hall.

412 **Clinical Gastroenterology** (5) Danish
Work in a suburban office devoted to private partnership practice of internal medicine with emphasis on gastroenterology. Hospital rounds, evaluation of problems, discussion with attending physician and patient of diagnosis and therapy, observation of and assistance in specialized procedures, practical aspects of office management. 4-week elective periods.

413 **Clinical Gastroenterology-Hepatology** (5) Dobbins
Intensive clinical experience with patients who have digestive diseases, including those of the gastrointestinal tract, liver, and pancreas. Patient consultations, teaching rounds, seminars. Joint conferences with surgery, pathology, and radiology staffs emphasize multidisciplinary approach to digestive diseases. 4-week elective periods. Univ. Clinic.

414 **Clinical Gastroenterology-Hepatology** (5) Seeff
Students work closely with Fellows in the gastroenterology/hepatology section, seeing patients on consultations and being involved in the initial evaluation, patient investigation, and follow-up. Close supervision is afforded by both the senior Fellows and senior staff. Direct or indirect participation in all specialized procedures involving various biopsy techniques and endoscopies. Teaching rounds, conferences, and seminars. 4-week elective periods. V.A. Hosp.

415 **Clinical Gastroenterology** (5) Gold
Course includes direct patient contact on a consultative basis and participation in all section activities, including reviews of gastrointestinal pathology and radiology for individual patients and all procedures, particularly endoscopic. The student will be expected to develop a fundamental core knowledge of basic gastroenterology and to participate in a journal activity and may be called upon to participate in a case presentation at monthly joint GI Grand Round sessions. 4-week elective periods. Wash. Hosp. Center.

416 **Gastroenterology—D.C. General Hospital** (5) Postow, Rudzki
Clinical gastroenterology. Participation in the daily activities: ward rounds with Fellows and attending physicians, endoscopic procedures (performed twice a week), journal club, GI medical-surgical conference, teaching conferences, and weekly clinic session. Direct responsibility for a number of consultations under the supervision of the GI Fellows. 4-week elective periods.

423 **Clinical Gastroenterology** (5) Trujillo, O'Kieffe
Introduction to clinical problems in diagnosis and treatment of gastroenterology in both office and hospital practice. Peritoneoscopy, endoscopy, and biopsies. 4-week elective periods. Univ. Hosp.

426 **Research in Metabolism of Sulphur Amino Acids** (15) Finkelstein
Study of methionine metabolism in mammalian tissues using several re-

search techniques: kinetic properties of purified enzymes; induction and repression of enzymes by hormones and diet; metabolism of methionine in the isolated perfused rat liver. Projects available in any of the above areas and will be developed further to meet student needs. 12-week elective periods. V.A. Hosp.

430 **Clinical Hematology** (5) Schechter* and Staff

Participation in the evaluation and treatment of patients with hematological disorders. Ward rounds, morphology review sessions, participation in hematology clinic and journal club. 4-week elective periods. V.A. Hosp.

431 **Clinical Hematology and Oncology** (5) Lessin and Staff

Immersion in the process of diagnosis and therapy of hematologic and oncologic disorders, including in-patient and out-patient consultations, daily care, and follow-up of clinical hematologic and oncologic problems. Emphasis on blood and marrow morphology, tumor pathobiology, and modern hematologic-oncologic diagnostic procedures. 4-week elective periods.

432 **Clinical Hematology** (5) Pierce

Clinical evaluation of in-patients and out-patients with symptoms referrable to the myelopoietic system using bedside and laboratory investigative parameters. 4-week elective periods. Wash. Hosp. Center.

433 **Hematology** (5) Rheingold

Observation of and participation in diagnosis and treatment of patients with hematologic disorders, in office (and hospital) setting. 4-week elective periods.

434 **Hematology-Oncology** (5 or 8) Pushkin

Assignment with senior resident seeing all patients with hematologic and tumor problems for whom consultation is requested. Interpretation of blood smears and blood coagulation studies. Assist in performance and interpretation of bone marrow examinations. 4- or 6-week elective periods. Providence Hosp.

436 **Hematology Research** (10 or 15) Schechter* and Staff

Research interests of the staff include lymphocyte biology and platelet production and hemostasis. Facilities available to do *in vitro* culture of human peripheral blood and bone marrow, radioisotopic studies, and electron microscopy. 8- or 12-week elective periods.

440 **Pulmonary Medicine** (5) Spagnolo

Participation in the diagnosis and therapy of patients with pulmonary disease; introduction to the management of patients with acute respiratory failure. Daily ward rounds, chest roentgenology review sessions, participation in journal club and physiology conference. Emphasis is placed on acquainting the student with modern pulmonary diagnostic procedures and current literature. 4-week elective periods. V.A. Hosp.

441 **Pulmonary Disease** (5 or 8) Weiss

Responsibility for the care of patients admitted with pulmonary problems as well as performing consultations on patients on other services. Daily rounds and a weekly teaching conference. Weekly pulmonary physiology conference in which arterial blood gases, pulmonary function testing, and principles of respiratory care are discussed in depth. Consultation services and daily care of a small number of inpatients. Exposure to such procedures as pleural biopsy, thoracentesis, lung needle biopsies, and arterial puncture. Involvement on a consulting basis with all patients in the intensive care unit with acute respiratory problems. 4- or 6-week elective periods. Providence Hosp.

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* Dr. Schechter is Chief of the Hematology Section at the Veterans Administration Hospital.

442 **Pulmonary Diseases** (5) Witorsch
Performance and interpretation of pulmonary function studies, including ventilatory, diffusing capacity, and blood gas analysis; daily teaching rounds and supervised consultation on patients with various pulmonary and infectious diseases. Participation in pulmonary clinic; techniques and principles of inhalation therapy. Principles of and experience with respiratory failure and respiratory intensive care. 4-week elective periods. Wash. Hosp. Center.

447 **Pulmonary Medicine** (5) Delaney, Spagnolo
Participation in the diagnosis and therapy of patients with pulmonary disorders. Ward rounds, chest roentgenology sessions, and participation in journal club. Emphasis on acquainting the student with modern diagnostic procedures related to patients with pulmonary diseases and current literature. 4-week elective periods. Univ. Hosp.

449 **Primary Care Elective** (5) Arling
Students assigned to European-trained family practitioner in small town on a Bahamian out-island. Caring for patients with medical, surgical, pediatric, obstetrical-gynecological, psychiatric, and tropical disease problems. Students responsible for their own transportation. 4-week rotations. Open to two students each period.

450 **Rheumatology Research** (10) Jacobs
Participation in ongoing clinical and laboratory research projects in the Division of Rheumatology. Major areas of research interest include methods of early diagnosis of septic arthritis, animal models of inflammatory joint disease, and alterations of collagen in degenerative and inflammatory arthropathies. 8-week elective periods. Univ. Clinic.

451 **Arthritis and Rheumatic Diseases** (5) Felts, Jacobs, Borenstein
Participation in the evaluation and treatment of patients with rheumatic diseases, including inpatient and outpatient consultations, daily care and follow-up, and clinical conferences. Regular discussions of selected topics in rheumatology, emphasizing differential diagnosis, pathophysiology, and therapeutic modalities. 4-week elective periods.

452 **Clinical Rheumatology** (5) Nachel
Active participation in the work-up and management of inpatients and clinic patients with rheumatic diseases. History, physical examination, differential diagnosis, immunological mechanism, x-ray reading, and use of laboratory tests will be stressed. 4-week elective periods. V.A. Hosp.

453 **Introduction to Arthritis** (5) Barth
Work-up, rounds, clinic, and consultations on patients with arthritis and rheumatic diseases. Daily discussions on selected topics in rheumatology, including clinical immunology, major disease categories (SLE, RA, gout, etc.), differential diagnosis, drug therapy, serological reactions, x-ray changes. 4-week elective periods. Wash. Hosp. Center.

455 **Rehabilitation Medicine** (5) Chiu, Enders
Management of 1–3 patients on the rehabilitation inpatient service under supervision. Initial medical and neurological work-up, setting of goals, and participation in team conferences. Outpatient work will include the use of electromyography and the neuromuscular examination as diagnostic tools, as well as management of common musculoskeletal conditions. Rounds and teaching activities. 4-week elective periods.

460 **Renal and Electrolyte Disorders** (5) Berkman
Participation in consultations, rounds, and outpatient clinic on patients with renal and electrolyte abnormalities; follow-up of patients. Examination of the urinary sediment, peritoneal, and hemodialysis. Conferences,

reading assignments, ward rounds, participation in journal club. 4-wee
elective periods.

461 **Clinical Renal Disease** (5) Parrill
Participation in clinical and laboratory procedures used in the study o
renal disease. Ward rounds, consultations, conferences, seminars. 4-wee
elective periods. Univ. Hosp.

463 **Clinical Application of Tissue Immunology** (5) Krump
Application of immunologic methods to the study of human hypersen-
sitivity states and metabolic diseases; study of serum proteins, includin
protein hormones and enzymes; research principles and methods; tissue
typing and fluorescent antibody methods. 4-week elective periods. Univ
Hosp.

465 **Renal Diseases and Fluid and Electrolyte Problems** (5) Jacobso
Participation in office and hospital consultations; care of patients wit
renal diseases and fluid and electrolyte problems. Familiarization wit
a variety of renal problems; work-ups of patients with renal disease
evaluation of renal function studies. Emphasis on critical use of medica
literature. 4-week elective periods.

469 **Clinical Renal Disease** (5) Shalhoub*
Broad exposure to and active participation in all the clinical activities o
the renal section, including consultations, hemodialysis, outpatient clinic
rounds, conferences, and journal club meetings. 4-week elective periods
Time period must first be cleared through instructor's office. V.A. Hosp

470 **Allergy Clinic** (5) Ratcliffe, Werth
Lectures, conferences, and attendance at allergy clinic where both adult
and child patients are seen. Detailed history-taking, physical examination
and skin-testing techniques. The student will have the option of dealing in
depth with an individual patient to learn more about the wide ramifica-
tions of severe allergic disease. Discussion of each case with an allergist
and development of complete management program. 4-week elective peri-
ods. Univ. Clinic.

471 **Allergy Clinic** (5) Evans, Summer
Lectures, conferences, and attendance at the allergy clinic where both
adult and child patients are seen. Detailed history-taking, physical ex-
amination, and skin-testing techniques. Discussion of each case with a
allergist to develop a complete management program. Emphasis on clini-
cal aspects of immunology. 4-week elective periods. Walter Reed Hosp.

472 **Private Office Practice of Allergy** (5) Bart
4-week elective period.

483 **Nuclear Medicine and Ultrasound** (5 or 10) Sauerbrunn†
Introduction to radioisotope methodology and ultrasound techniques as
applied to diagnosis in medicine. Interrelation and complementary use of
both modalities in evaluating the patient who presents with a diagnostic
problem. 4- or 8-week elective periods.

495 **Oncology Review** (5) Hollinshead
Each student is assigned a carefully selected reading list on one form of
cancer. Fundamentals, basic research, and latest clinical approaches are
discussed in detail. Each student will write and illustrate a review of his
or her subject. Interested students are encouraged to undertake their own
research project the following summer. 4-week elective period.

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* Dr. Shalhoub is Chief of the Renal Section at the Veterans Administration Hospital.
† Dr. Sauerbrunn is Chief of Nuclear Medicine at the Veterans Administration Hospital.

Microbiology

Chairman: L.F. Affronti

Professors L.F. Affronti, K. Huang, R. Hugh, P.D. Kind, E.M. Lerner II *(Research)*, M. Reich
Associate Professors J.W. Albright *(Research)*, C.V. Reich *(Research)*, G.V. Stokes
Adjunct Associate Professor J.D. MacLowry
Associate Professorial Lecturer R.D. Donnelly
Assistant Professors B.T. Backus *(Research)*, G.E. Wagner
Adjunct Assistant Professors J.A. Bradlaw, V.M. Turner

128 **Microbiology for New Health Practitioners** (2) — **Staff**
Lecture course for students in Allied Health program. Basic concepts of microbiology and principles of microbial defense. Study of microorganisms of medical importance.

129 **Immunology: Introduction to Immunologic Fundamentals** (3) — Affronti, Silver
Lecture course for medical technology class; open to others. Fundamental immunologic concepts. Serologic and immunologic procedures as applied to clinical and research situations. Prerequisites: an introductory microbiology course and chemistry (inorganic and organic), or permission of instructor. (Spring)

*201 **Medical Microbiology** (8) — **Staff**
For medical students; open to qualified graduate students with permission. Bacteria, rickettsiae, viruses, yeasts, molds, protozoa, metazoa, and immunological concepts which relate to the health and disease of humans —cultural studies, methods of diagnosis, theories. Laboratory fee for nonmedical students, $20. (Spring)

211 **Microbiology** (4) — **Staff**
For graduate students. Bacteria, viruses, rickettsiae, fungi, parasites, and immunological concepts. Prerequisite or concurrent registration: Bioc 221–22 or other biochemistry course and permission of instructor. Laboratory fee, $20. (Fall)

212 **Pathogenic Bacteriology** (3) — **Hugh**
Principles of bacteriology and pathogenic characteristics of bacteria with emphasis on pathogenesis, prevention, and control of bacterial disease of man. Prerequisite: Micr 211 or equivalent. Laboratory fee, $20. (Spring)

214 **Tissue Cell Culture** (3) — **Staff**
Fundamental aspects of tissue culture with emphasis on mammalian cells. Specialized techniques and applications of cell culture procedures with emphasis on quality control practices. Prerequisite: Micr 211 or equivalent. (Spring)

215 **Parasitology** (2) — **Turner**
For graduate students; open to medical students. Study of host-parasite relationships. Clinical recognition of important parasites in medicine. (Fall)

* Required for medical students.

219 **Scientific Writing** (1) Wag
Provides basis for preparing theses, dissertations, and publications. (Fa

223 **Antimicrobial Chemotherapy** (1) Reich, Affro
For medical students. Lecture course. Selection, clinical applications, a mechanism of action of various drugs and antibiotics used in the trea ment of microbial infections. Members of the clinical faculty discuss re vant aspects of clinical chemotherapy. Prerequisite: Micr 201. (Fa

225 **Microbial Physiology I** (3) Rei
Microbial structure, nutrition, transport, growth, genetics, metabolism a regulatory mechanisms. Prerequisite: Bioc 221–22, Micr 211, or equi lent. (Fall)

226 **Microbial Physiology II** (3) Reich, DeGiovanni-Donn
Actions of antimicrobial agents and antibiotics on the structure and b chemistry of microorganisms at the cellular and molecular levels. Pr requisite: Micr 225 or permission of instructor. (Spring)

227 **Microbial Physiology Laboratory** (2) Rei
Application of laboratory techniques and instrumentation to topics co ered in Micr 225–26. Prerequisite Micr 226. Laboratory Fee: $20. (Fall)

229 **Immunology** (3) Kind, Affron
Lecture course. Fundamental immunologic concepts. Lectures cov antigens, antibodies, antigen-antibody reactions *in vitro* and *in vivo*, an the immune response. Prerequisite: Micr 211 or permission of instructo

230 **Immunology Laboratory** (2) Kind, Affron
Methods in serology, immunochemistry, and cellular immunology tha are used in research laboratories are emphasized. Prerequisite or con current registration: Micr 229 or permission of instructor. Limited t students enrolled in a degree program. Laboratory fee, $20. (Fall, od years)

231 **Immunobiology** (1) Affronti, Ki
Lecture course. Study of immunological functions of reticulo-endothe tissues, theories of autoimmunity, graft rejection, tumor immunity, de layed hypersensitivities, and immunogenetics. Members of the clinica faculty discuss relevant aspects of immunobiology. For medical student open to graduate students with permission of instructor. Stoll

233 **Virology** (3)
Biochemical, genetic, and pathogenic characterization of viruses. Pre requisite: Micr 211 or equivalent. (Fall) Stoll

234 **Virology—Laboratory** (2)
Laboratory complement to Micr 233. Prerequisite or concurrent registra tion: Micr 233. Laboratory fee, $20. (Fall) Hop

235 **Systematic Bacteriology** (2)
History of bacterial classification, international rules of nomenclature a applied to bacteria, development of bacterial classification based on rel tionships, survey of characteristics of bacterial groups. Prerequisite: Mi 201 or 212 or equivalent. (Fall, odd years) Hop

251 **Clinical Laboratory Bacteriology** (3)
For graduate students; open to medical students. Detection and identifica tion of bacterial agents which cause diseases in humans. Comparativ isolation and identification methods; emphasis on interpretation and sig nificance of laboratory observations. Prerequisite: Micr 201 or equiva lent. (Fall, even years)

252 **Medical Parasitology** (1) Turner
(Formerly Medical Protozoology)
For medical students; open to graduate students. Lecture and laboratory course. Life cycles, epidemiology, clinical manifestations, pathology, diagnosis, treatment, and prevention of medically important protozoan and helminthic infections are presented. In the laboratory, the recognition and identification of the etiologic agents causing disease through the study of living and preserved specimens are emphasized. (Fall)

255 **Clinical Virology** (1) Huang
Primarily elective course for medical students; open to graduate students. General principles of virology; emphasis on clinical situations. Prerequisite: Micr 201 or equivalent. (Fall)

257 **Experimental Immunochemistry** (3) Affronti
Biochemical and physiochemical characterization of antigens and antibodies. Prerequisite: Bioc 221–22 or equivalent, Micr 229. Laboratory fee for nonmedical students, $20. Limited enrollment. (Spring, even years)

258 **Microbial Genetics** (2) De Giovanni-Donnelly
Survey of microbial systems that depict basic concepts of genetic principles. Prerequisite: Micr 211 or equivalent. (Spring)

260 **Cellular Immunology** (1) Kind
Advanced seminars in cellular aspects of the immune response. Content differs each time course is offered. May be repeated for credit. Prerequisite: Micr 229. (Spring)

277–78 **Seminar: Microbiology** (1–1) Staff
Required of graduate students. (Academic year)

280 **Virology** (10) Huang
Selected problems, library assignments, laboratory studies. 8-week elective periods.

281 **Biological Basis of Infections** (5) Affronti, Reich
Selected problems, library assignments, laboratory studies, term paper. 4-week elective periods.

282 **Immunology** (5) Kind, Affronti
Selected problems, library assignments, laboratory studies, term paper. 4-week elective periods.

283 **Bacteriology** (10) Hugh
Selected problems, library assignments, laboratory studies, term paper. 8-week elective periods.

289 **Inflammation, Immunity, and Hypersensitivity** (5) Affronti, Kind
4-week elective periods.

290 **Extramural Microbiology Elective** (arr.)
The department arranges for medical students to spend elective periods in other institutions. Interested students should contact the chairman of the department.

293 **Special Topics in Microbiology** (arr.) Staff
Selected topics in microbiology. May be repeated for credit. (Fall and spring)

295 **Research in Microbiology** (arr.) Staff
Content differs each time the course is offered; may be repeated for credit. (Fall and spring)

299–300 **Thesis Research** (3–3) Staff
(Fall and spring)

398 **Advanced Reading and Research** (arr.) Staff
Limited to students preparing for the Doctor of Philosophy general examination. May be repeated for credit. (Fall and spring)

399 **Dissertation Research** (arr.) Staff
Limited to Doctor of Philosophy candidates. May be repeated for credit. (Fall and spring)

Neurological Surgery

Chairman: H.V. Rizzoli

Professors J.J. Bernstein *(Research)*, A.I. Kobrine, T.H. Milhorat, G.A. Morales, H.V. Rizzoli

Clinical Professors M.G. Alper, H.H. Ammerman, F.D. Cooney, G. Dichiro, G.J. Hayes, N.H. Horwitz, A.P. Hustead, C.L. Li, A.K. Ommaya, D.A. Ruge

Professorial Lecturers V.W. Armbrustmacher, K.M. Earle, P.L. Kornblith

Associate Professors C.B. Early, D.E. Evans

Associate Clinical Professors W.E. Lawrinson, E.U. Mannarino, J.P. Murphy

Assistant Professors I.S. Baron-Starke, M.K. Hammock, S. Koulouris

Assistant Clinical Professors B.J. Ammerman, J.W. Barrett, E.B. Byrd, C.P.H. Carroll, M.W. Dennis, J.R. Howe, J. Kushner, E.A. Quindlen, F.T. Schwartz, B.H. Smith

Clinical Instructors K. Ghaemi, B. Stopak

302 **Clinical Clerkship in Neurosurgery** (3) Staff
2-week elective periods. Univ. Hosp.

380 **Clinical Neurosurgery** (5) Staff
Clinical clerkship in neurosurgical service. Emphasis on neurologic examination; indications for special neurologic and operative procedures. 4-week elective periods. Med. Fac. Assoc.

382 **Clinical Neurosurgery** (5) Early
Participation in all departmental activities: ward rounds, daily conferences, radiographic and pathologic studies, operating room procedures. 4-week elective periods. Nat'l Naval Med. Center.

383 **Pediatric Neurosurgery** (5) Milhorat
Participation in all departmental activities: ward rounds, daily conferences, radiographic and pathologic studies, operating room procedures. 4-week elective periods. Children's Hosp.

387 **Clinical Neurosurgery** (5) Staff
Participation in all departmental activities, including ward rounds, daily conferences, radiographic and pathologic studies, and operating room procedures. 4-week elective periods. Wash. Hosp. Center.

390 **Extramural Neurosurgery Elective** (arr.)
The department arranges for students to spend elective periods in other institutions. Interested students should contact the chairman of the department.

Neurology

Chairman: G.F. Molinari

Director of Encephalographic Laboratory: A. Racy

Professors C.K. Conners, D.O. Davis, G.F. Molinari, S. O'Reilly, S.A. Shelburne, Jr.

Adjunct Professors C.H. Gunderson, D.E. McFarlin

Clinical Professor W.K. Engel

Professorial Lecturer N.P. Goldstein

Associate Professors A.B. Barnet, R.A. Lavine, M.M. Platt, P.F. Teychenne

Associate Clinical Professors K. Abraham, R.N. Edelson, D.J. Fishman, A.J. Levens, N.C. Myrianthopoulos, K.B. Nelson

Assistant Professor C.S. Chang

Assistant Clinical Professors F.H. Anderson, V.J. Blazina, M.M. Davis, V.A. Duggins, G.P. Gabe, A.P. Galdi, J.F. Grim, J.E. Hogg, M.C. Korengold, R. Kratz, R. Laureno, W.E. Lightfoote II, N.A. Luban, W.E. Lux, Jr., J.F. Morales, L.K. Ng, M.A. Osborn, K.C. Rickler, D. Satinsky, H.M. Silby, E.C. Wilner

Instructor H.A. Emsellem

Adjunct Instructor M.E. Archutowska-Kempka

Clinical Instructors J.A. Armer, H.S. Mickel, H.T. Vollero, J.R. Wittenborn, Jr.

380 **Clinical Neurology** (5) — **Molinari and Staff**
Emphasis on neurologic examination; indications for special neurologic tests, e.g., arteriograms, pneumoencephalograms. 4-week elective periods. Univ. Hosp.

383 **Clinical Neurology** (5) — Gunderson
Emphasis on neurological examination and basic sciences, including neuroanatomy, as applied to clinical material. 4-week elective periods. Walter Reed Gen. Hosp.

384 **Clinical Neurology** (5) — Laureno, Staff
Clerkship in neurology. Participation in neurology consultation service, clinic, and seminars. In-depth research for formal seminar presentation. 4-week elective periods. Wash. Hosp. Center.

390 **Extramural Neurology Elective** (arr.)
Students electing clerkships at the University Hospital can spend another elective period in another institution. They should arrange the elective with the other institution and bring a letter of acceptance to the chairman of the department of neurology for approval. The student is responsible for reporting the grade received to the department of neurology, which in turn will submit it to the Associate Dean for Student Affairs and Admissions.

Obstetrics and Gynecology

Chairman: A.B. Weingold

Professors R.H. Barter, J.B. Craft, Jr., L. McGowan, C.C. Rogers, J. Schulman, J.G. Sites, B. Waxman, A.B. Weingold

Clinical Professors S.M. Belinsky, W.H. Cooper, O.I. Dodek, Jr., M.P. Foote, J.M. Friedman, J.M. Grodin, H.L. Kotz, W.P. McKelway, W.E. Patow, J.W. Pearson, Jr., N.J. Price, N.M. Tart, E.W. Titus, Jr., J.C. Walsh, T.A. Wilson

Professorial Lecturers L.M. Hellman, D.H. Kushner, J.L. Sever, J.B. Sheffery

Associate Professors M.C. Edwards, M.A. Fletcher, J.H. Grossman III, J.V. Larsen, Jr.

Associate Clinical Professors A.A. Becker, J.M. Close, S.D. Cooley, E.F. Gahres, C.R.A. Gilbert, E.K. Herz, H. Klaus, J.J. Kuhn, W.T. Lady, S.S. Lipsius, L.M. Liverett, S.C. Marinoff, D.H. Martin, L.Q. Pugsley, A. Robins, M. Rosenbaum, I.W. Rovner, J. Sacks, P. Soyster, S.F. Stewart, Jr., H.P. Treichler

Assistant Professors A.J. Friedman, J.L. Marlow, R.J. Stillman

Assistant Clinical Professors J.E. Anderson, E. Atiemo, R.E. Badwey, B.A. Band, H.C. Beaver, J.D. Berryman, D.R. Carlson, D.C. Cinnamon, W.T. Cooper, E.E. Cunningham, A.A. De Moya, K.A. De Sandies, S.J. Dispenza, Jr., R.V. Erkenbeck, L.E. Fettig, J. Fogel, S.P. Gardner, C.S. Greenhouse, T.H. Gresinger, A.J. Heintze, V.B. Hugh, M.A. Jerome, S.R. Johnson, E.C. Koch, E.R. Kolvereid, M.K. Kowalski, A.I. Lao, A.M. Lazarus, S.T. Lee, L.S. Levine, R.H. Levitt, J.W. Lyles, R.S. Margolis, D.M. Margulies, L.A. Martel, R.J. Orleans, J.C. Pan, J.D. Paulson, W.R. Perkins, L.C. Radisse, P.K. Rattan, M.J. Roberts, M.W. Sandmeyer, Jr., C.I. Schneiderman, S.H. Shea, J.C. Skilling, G. Speck, C.E. Townsend, C.L. Wagstaff, W.D. Wallace, Jr., A.W. Winshel

Assistant Professorial Lecturer A. Kramm

Instructors M.M.R. Davis, S.W. Jaffe

Clinical Instructors J.E. Alarcon, J.C. Bolan, P.A. Bryce, R.L. Castle, T.A. Cook, Jr., P.D. Cowell, B.G. Douglas, C.M. Ezekwueche, R.D. Footer, J.B. Greenberg, A.A. Greenfield, S.J. Horwitz, C.M. Jackson, C. Kim, B.A. Kleinman, J.H. Lane, K.H. Neblett, O.S. Oredein, R.J. Pierce, D.N. Powers, J.C. Rajagopal, S.G. Roberts, L.A. Rosen, M.A. Ross, R. Rosser, Jr., B.S. Rothman, L.S. Sabella, J.E. Safran, S.A. Schlosser, T.W. Scott, M. Vatin

Special Lecturer T.E. Schmitt

Staff

*303 **Clinical Obstetrics and Gynecology** (10)
Participation in all obstetrical and gynecological clinics, daily departmental conferences and ward rounds at University, Fairfax, and Holy Cross Hospitals. Manikin demonstrations of mechanism of labor and various types of operative delivery. (8-week periods throughout academic year)

Waxman

375 **Family Planning and Contraception** (5)
Participation in the department's family planning clinics at the Medical Center and Southeast Neighborhood Clinic, with some office practice and gynecologic screening practices. 4-week elective periods.

* Required for medical students.

376 **Gynecologic Oncology** (5) McGowan
Participation in all aspects of clinical inpatient and office diagnosis and treatment of women with gynecologic cancer. Related research. 4-week elective periods. Med. Fac. Assoc.

377 **Cytogenetics and Prenatal Diagnosis of Birth Defects** (5) Fabro, Larsen
Study and participation in research on the chemical aspect of diagnosis and prevention of birth defects. Patient screening for genetic defect, ultrasonography, and amniocentesis. 4-week elective periods.

378 **Reproductive Endocrinology** (5) Stillman
Participation in patient management of infertility, encompassing infertility work-up, operative diagnostic and threapeutic procedures, and management of gynecologic endocrine and infertility problems. 4-week elective periods.

379 **Perinatal Infectious Diseases** (10) Grossman
Study and participation in research in infectious diseases of pregnancy and the intrapartum period. 8-week elective periods.

380 **Clinical Obstetrics and Gynecology** (5) Gahres, Radice, Rothman
Participation in patient care, clinics, surgery, and delivery. 4-week elective periods. Alexandria Hosp.

381 **Perinatal Medicine** (5) Weingold, Fabro
Participation in high-risk obstetrics clinics and antepartum and intrapartum management of high-risk and normal obstetrical patients. Participation with the Fellow in maternal-fetal medicine at the University Hospital and outlying hospitals. 4-week elective periods.

383 **Clinical Gynecology** (5) Footer, Friedman
Participation in office practice of obstetrics and gynecology. 4-week elective periods.

386 **Clinical Obstetrics and Gynecology** (5) Cooper, Perkins
Participation in office practice of obstetrics and in gynecological surgery and delivery. 4-week elective periods.

387 **Inpatient Obstetrics and Gynecology** (5) Park
Supervise obstetrics and gynecology in a large military hospital; rounds and conferences. 4-week elective periods. Walter Reed Hosp.

390 **Extramural Obstetrics and Gynecology Elective** (arr.)
The department arranges for students to spend elective periods in other institutions. Interested students should contact the chairman of the department.

Ophthalmology

Chairman: M.F. Armaly

Professors M.F. Armaly, D.S. Friendly, D.E. Krueger *(Research)*
Clinical Professors M.G. Alper, M.M. Parks, L.E. Zimmerman
Associate Professors B.S. Fine *(Research)*, J.S. Zacharia
Associate Clinical Professors W.S. Gilbert, L.M. King, Jr., F.G. La Piana
Assistant Professors Y. Jung *(Research)*, P.J. Riddle
Adjunct Assistant Professors R.M. Chavis, D.F. Greer

Assistant Clinical Professors D.G. Albert, D.K. Berler, H.N. Bernstein, [illegible] Casey, W.P. Chalfant, Jr., R. Day, A.L. Fjordbotten, T. Frey, P.T. Ga[illegible] W.B. Glew, H.B. Gould, T.P. Keenan, M.D. Krinn, M.E. Lederman, [illegible] Lodge, J.F. O'Neill, S.S. Pappas, D.E. Schwartz, K.A. Simon, J. Sm[illegible] R.F. Stephens, S. Stoleru, R.N. Sunga, M.A. Von Fricken, D.M. Wan[illegible] P.V. Whitmore, H.S. Wicker, B.H. Zeavin, E.M. Zimmerman, M.H. Z[illegible] merman

Clinical Instructors B.S. Bruner, R.S. Deitch, P.A. Dorn, Jr., A.E. Eager, [illegible] Edmonds, B. Ehrlich, L.M. Friedman, M.L. Gaspar, W.H. Hall, R. Hu[illegible] man, W.S.N. Ibrahim, L.L. Kogan, D.L. Lanter, G. Liss, J.F. Nowell, [illegible] Perraut, H.I. Rodman, N.J. Ronsheim, H.J. Starr, E.M. Titer

281 **Ophthalmic Pathology I** (1) L. Zimmerm[illegible]
Basic science aspects of diseases of the eye. (Spring)

282 **Ophthalmic Pathology II** (3) L. Zimmerm[illegible]
Diseases of the eye as revealed by gross and microscopic examination. Op[illegible] to eight students. Armed Forces Inst. of Path. (Spring)

284 **Ophthalmic Pathology III** (5) L. Zimmerm[illegible]
Daily participation in service limited to pathology of the eye and [illegible] adnexa. 4-week elective periods. Armed Forces Inst. of Path.

381 **Clinical Ophthalmology** (3 or 5) Armaly and St[illegible]
Observation and participation in examination, diagnosis, and manageme[illegible] of wide variety of ocular conditions in ambulatory patients. Emphasis o[illegible] conducting a general ophthalmic examination, recognition of abnorm[illegible] findings, and management of common ocular diseases. Lectures, rounds, and seminars, 2- or 4-week elective periods. Burns Bldg.

382 **Clinical Ophthalmology** (3 or 5)
Observation and participation in examination, diagnosis, and manageme[illegible] of wide variety of ocular conditions. Emphasis on conducting a gener[illegible] ophthalmic examination, recognition of abnormal findings, and manag[illegible] ment of common ocular diseases. Lectures, rounds, and seminars. 2- or [illegible] week elective periods. Nat'l Naval Med. Center.

390 **Extramural Ophthalmology Elective** (arr.)
Special elective program arranged for selected students at other institutio[illegible] Interested students should contact the chairman of the department.

Orthopaedic Surgery

***Chairman:* J.P. Adams**

Professors J.P. Adams, H.L. Feffer, W.P. Fortune, P.I. Kenmore, F. Leonard *(Research)*, D.W. McKay, R.J. Neviaser, R.S. Snell

Associate Professors S.F. Gunther, S.S. Nason, D.B. Parsons *(Research)*, B.K. Slemmons

Adjunct Associate Professor G.P. Bogumill

Associate Clinical Professors D.M. Brody, R.L. Dow, U.M. Fortune, S.S. Has[illegible] R.J. Lewis, B.P. Vitek

Assistant Professors H.O. Goller *(Research)*, M.M. Malawer, R.B. Reff, S.W. Wiesel

Adjunct Assistant Professor H.S. Cattell
Assistant Clinical Professors A.I. Dobranski, S.H. Eisenberg, M.M. Gardner, S.A. Lavine, C.C. MacCartee, Jr., C.W. McCutchen, P.A. Moskovitz, T.J. Neviaser, S.R. Rothschild, G.J. Schonholtz, M.A. Schultz, J.F. White
Instructor P.A. Labropoulos
Adjunct Instructor W.J. Sadlack
Clinical Instructors B.R. Ain, R.L. Gaertner, J.H. Graeter, J.W. Harvey, D.C. Johnson, R.G. Loeffler, H.N. Mininberg, F.R.T. Nelson, R. Ottenberg

°302 **Clinical Clerkship in Orthopaedic Surgery** (3) — Labropoulos and Staff
Basic clinical rotation in orthopaedics for second- and third-year students and fourth-year students who have not had previous orthopaedic rotations. Inpatient, outpatient, and emergency clinical care, with ward and night call responsibilities. Physical diagnosis, x-ray interpretation, trauma, and reconstructive surgery. 2-week elective periods. Univ., Children's, or V.A. Hosp. or Wash. Hosp. Center (predetermined by department).

351 **Trauma** (1) — Adams, Haas, Snell
Relation of trauma to other disease entities and understanding of its effects on the musculoskeletal system. Description of pathophysiological changes on tissues locally and systemically and of psychological reactions that may accompany such changes. (Spring)

380 **Orthopaedic Surgery** (5) — Labropoulos
Students participate in care of orthopaedic inpatients and outpatients, daily rounds, and conferences under the direction of a faculty member at the University Hospital or one of the affiliated hospitals. Prerequisite: Orth 302. 4-week elective periods.

382 **Research in Orthopaedic Surgery** (arr.)
Participation in orthopaedic research to be arranged with various faculty members. Prerequisite: Orth 302.

383 **Sports Medicine** (3 or 5) — Adams
Introduction to athletic injuries, including prevention and management. Prerequisite: Orth 302. Interested students should contact Dr. Adams. 2- or 4-week elective periods.

390 **Extramural Orthopaedic Surgery** (arr.) — Adams
The department arranges for students to spend elective periods in other institutions. Prerequisite: Orth 302. Interested students should contact the chairman of the department.

395 **Research in Orthopaedic Surgery** (arr.) — Adams
4-, 8-, 12-, or 16-week elective periods. Univ. Hosp.

Otolaryngology

Chairman: J.J. McFarland, Jr.

Clinical Professors N.L. Barr, Jr., D.N.F. Fairbanks, J.J. McFarland, R.S. Page, Jr., R.E. Pumphrey, Jr., W.M. Trible, B.M. Webb

° Required for medical students.

Associate Clinical Professors S. Epstein, B.A. Feldman, M.J. Fischer, I. Jaffee, M.E. Krucoff, J.L. Levine, J.A. Sabri, A. Small
Assistant Clinical Professors R.J. Bobys, W.R. Bond, Jr., B.D. Burtoff, D. Feldman, E.J. Hager, G.F. Miller, Jr., S.B. Schreiber
Clinical Instructors P.A. Coyne, S.B. Hopping, D. Isaacson, B. Modlin, H.H. Scheidemandel, H.C. Stein

380 **Otolaryngology** (3 or 5) Tribb
Care of inpatients and outpatients. Diagnosis, therapy, rounds, and conferences. 2- or 4-week elective periods. Wash. Hosp. Center.

381 **Otolaryngology** (3 or 5) Fairbank
Participation in care of outpatients, diagnosis, and therapy; rounds and conferences. 2- or 4-week elective periods. Private office practice.

390 **Extramural Otolaryngology Elective** (arr.)
The department arranges for students to spend elective periods in other institutions. Interested students should contact the chairman of the department.

395 **Clinical Clerkship** (3 or 5) Staff
Inpatient and outpatient rotations; operating room experience. 2- or 4-week elective periods. Nat'l Naval Med. Center.

Pathology

Chairman: H. Sidransky

Professors S. Bloom, J.M.B. Hicks, W.L. Marsh, M.J. Matthews, F.N. Miller, Jr., D.S. O'Leary *(Laboratory Medicine)*, H. Sidransky, B.H. Smith, M.J. Valaske, M. Werner *(Laboratory Medicine)*
Clinical Professors C.F. Bishop *(Radiation Therapy)*, C.B. Cook, L.G. Dickson, G.H. Guin, E.B. Helwig *(Dermatologic Pathology)*, N.S. Irey, F.B. Johnson, P.C. Legolvan, J.L. Luke *(Forensic Pathology)*, R.S. Melville *(Laboratory Medicine)*, R.E. Palmer, D.L. Weiss, M.J. Williams, L.E. Zimmerman *(Ophthalmic Pathology)*
Professorial Lecturers T.T. Antonovych, P.D. Olch *(History of Medicine)*, A.S. Rabson, W.C. Roberts *(Cardiology)*
Associate Professors A.A. Abraham, Y. Al-Doory *(Laboratory Medicine)*, R.S. Chandra, C.T. Garrett, J.H. Grossman III, J.G. Guccion, F.S. Jannotta, S.G. Kent, R.B. Lingeman, Y.C. Oertel, L.G. Ortega, N.K. Saini, B.C. Zook *(Comparative Pathology)*
Adjunct Associate Professors J. Costa, S.R. Jones, R.J. Montali, J.M. Ward
Associate Clinical Professors B.D. Blackbourne *(Forensic Pathology)*, G.G. Brennan, W.F. Enos, I.D. Godwin, D.R. Parkinson
Associate Professorial Lecturer H.R. Schumacher
Assistant Professors K.H. Fischer *(Allied Health Sciences)*, H.P. Hawley, Jr., S.P. Kapur, C.N. Murty *(Research)*, C.M. Myrie, L.E. Nochomovitz, J.M. Orenstein, R.H. Patterson, S. Silver, C.J. Zaloudek, J.A. Zeller *(Laboratory Medicine)*

Adjunct Assistant Professors L.P. James, S. Kanhouwa, J.B. Moe, R. Singh
Assistant Clinical Professors G. Controni, F.W. Darr II, J.L. Hall, L.G. Hefter, P. Lupovich, M.S. Nandedkar, M.K. Rifaat
Assistant Professorial Lecturers M.T. Jessee, C.S.W. Lay, C.W. Locke, Jr., W.P. Monaghan, D.E. Uddin
Instructors R.E. Dayhoff *(Research)*, R.T. Penna
Lecturers S.F. Boas, B.C. Cloherty, J.E. Forey, R.S. Horkman, J.W. Jones, R.J. Mohrbacher, W.A. Rey, C.J. Riendeau, J.M. Salata, D.G. Simons, R.J. Yankey
Special Lecturers A.A. Cooper, C.E. Daniels, W.C. Fox, S.G. Gerding, J.W. Guthrie, J.T. Johnson III, J.E. Montgomery, L.W. Ouderkirk, A.L. Richards, C.V. Tresnak, D.B. Waldron

Courses numbered 13 through 20 are limited to military personnel in the Medical Laboratory Technique Program.

13 **Hematology** (6) Staff
Basic hematologic procedures, diagnosis of abnormalities of cellular elements of blood and bone marrow, studies in blood coagulation, quality control in clinical hematology.

14 **Blood Banking** (6) Staff
Principles of immunohematology, blood donor center techniques, blood processing techniques, quality control in blood banking.

15 **Clinical Laboratory Rotation** (14) Staff
Instructions in laboratory technique, stressing the application of theories and principles of clinical chemistry, clinical microbiology, hematology, and blood banking in the day-to-day operations of the modern clinical laboratory.

16 **Clinical Chemistry** (5) Staff
Principles and techniques of blood chemistry analyses, including toxicological analyses for drugs of abuse and environmental poisons.

17 **Urinalysis** (2) Staff
Principles and techniques of urine chemistry and microscopic analysis.

18 **Bacteriology** (6) Staff
Identification of pathogenic micro-organisms by morphologic and cultural techniques.

19 **Parasitology** (4) Staff
Identification of human parasites and their life cycles; concentration methods, staining techniques, and media for culture.

20 **Serology** (2) Staff
Principles and techniques of antigen-antibody reaction and immunological responses.

Courses numbered 121 through 128 and 130 through 133 are open only to students enrolled in the Bachelor of Science degree program with a major in medical technology.

121 **Introduction to Medical Technology** (4) Silver
Six-week orientation in laboratory medicine. **(Fall)**

122 **Clinical Chemistry Lecture** (3) Staff
Lecture series on routine and special clinical chemistry techniques. **(Spring)**

123 **Clinical Microbiology Lecture** (2)
Lecture series on bacteriology, mycology, and virology. (Fall)

124 **Blood Bank Lecture** (1) Marsh and
Lecture series on immunohematology and transfusion service. (Spring

125 **Clinical Hematology Lecture** (2)
Lecture series on routine and special hematology and coagulation.

126 **Selected Topics in Laboratory Medicine** (2) Smith.
Lecture and laboratory series on clinical parasitology. Miscellaneous topics in fluid analysis. (Spring)

129 **Pathology for New Health Practitioners** (3)
Lecture course with optional laboratory. Basic pathologic concepts of infectious diseases, language of pathology, fundamental disease processes. Emphasis on pathogenesis and dynamics of disease. Causation, evolution and morphology of pathologic changes in the principal diseases of each organ system presented in coordination with clinical lectures in Idis 3. (Fall and spring)

130 **Clinical Chemistry** (4)
Rotation through the University hospital clinical chemistry laboratory. (Fall and spring)

131 **Clinical Microbiology** (4)
Rotation through the University hospital clinical microbiology, mycology, and parasitology laboratories. (Fall and spring)

132 **Hematology/Coagulation** (4)
Rotation through the University hospital clinical hematology and coagulation laboratories. (Fall and spring)

133 **Blood Bank/Serology/Urinalysis** (4)
Rotation through the University hospital blood bank, serology, and urinalysis laboratories. (Fall and spring)

152 **Introduction to Basic Laboratory Medicine** (2)
Theory, performance, and interpretation of some important routine clinical laboratory tests performed in a physician's office, such as complete blood counts with differentials, staining and reading smears, urinalysis and microbiological culture and staining techniques, and organism identification. Lectures, demonstrations, audiovisuals, and laboratory. Prerequisite: Path 129. (Summer)

*201 **Pathology** (8)
A year course; required for second-year medical students. General introduction to concepts of disease. Pathology of organ systems; correlation with symptoms and physical signs. Gross and microscopic study of diseased tissues. Case studies.

203–4 **Pathology** (4–4)
For graduate students. General introduction to concepts of disease. Pathology of organ systems; correlation with symptoms and physical signs. Gross and microscopic study of diseased tissues. Case studies. Limited enrollment. Prerequisite to Path 204: Path 203. (Academic year)

217 **Gross Autopsy Pathology** (1) Orenstein
Review of current necropsy cases. Interpretation of clinical symptoms and signs and radiographs on the basis of gross changes in organs. Limited to second-year medical students. Univ. Hosp. (Spring)

220 **Medical Mycology** (2–4) Al-Doory
Lectures and laboratory to cover pathogenic fungi, mycotic diseases, and their clinical aspects. Laboratory fee, $20. (Fall)

*Required course for medical students.

222 **Opportunistic Mycoses** (2) Al-Doory
Study of the opportunistic fungal infections and their serological, clinical, and therapeutic aspects. Emphasis on identification of fungi and evaluation of laboratory findings. Limited to second-year medical students. (Spring)

252 **Forensic Pathology** (1) Blackbourne
Somatic death, coroner and medical examiner systems, pathology of physical and chemical injuries. Limited to second-year medical students. (Spring)

253 **Medicine in Shakespeare** (1) Miller
Seminars with student and staff presentations covering the medically significant plays of William Shakespeare. Open to first- and second-year medical students. (Spring)

254 **Medicine in Literature** (1) Miller
Series of discussions with student and staff presentations covering novels, drama, nonfiction, and poetry of medical significance. Open to first- and second-year medical students. (Fall)

256 **Pathology of Infectious Diseases** (3) Abraham
Correlation of clinical, physiologic, immunologic, and pathologic mechanisms determining the course and morphological changes occurring in infections. Involves analysis of human case material and review of assigned selected readings. Prerequisites: Micr 211 and Path 203.

257 **Transmission Electron Microscopy in Pathologic Diagnosis** (3) Orenstein, Abraham
Techniques for the examination and interpretation of ultrastructural changes associated with human disease states. Emphasis on transmission electron microscopy as a diagnostic tool. Prerequisites: Path 203–4, Anat 260, Anat 261.

258 **Organ System Pathology** (5) Bloom
Gross and microscopic study of human pathologic material reflecting major diseases of specific organ systems. The organ systems studied will be rotated annually depending on demand. Organ systems to be covered include cardiovascular, digestive, nervous, renal, reproductive, and respiratory. Prerequisite: Path 203–4. Permission of instructor required. (Fall and spring)

261 **Seminar in Experimental Pathology** (1) Sidransky
Current topics in research in experimental pathology. Limited to second-year medical students. (Spring)

266 **Comparative Pathology Elective** (1) Zook
Participation in an autopsy service involving captive wild animals. Comparison of diseases in various animal species with those in humans. Limited to second-year medical students. Path. Lab., Nat'l Zoological Park. (Spring)

280 **Surgical Pathology I** (2) Silverberg
Surgical pathology service at participating hospitals. Examining specimens from current surgical cases, correlating with clinical manifestations. Univ. Hosp. (Spring—3 hours per week)

284 **Ophthalmic Pathology** (5) Zimmerman
Daily participation in an active service limited to pathology of the eye and its adnexa. Inflammatory, degenerative, and neoplastic diseases comprise the major categories. 4-week elective periods. Armed Forces Inst. of Path.

286 **Perinatal Pathology** (arr.) Kent
Focuses on important disorders that may beset the human fetus during the intrauterine period of gestation and the infant during the early neonatal period. Emphasis on the role of placental abnormalities. Prerequisite: Path 203 or equivalent. (Spring)

289 **Clinical and Anatomical Pathology** (5) Cook
Participation in daily studies of surgical and necropsy pathology, including forensic pathology; clinical pathology projects including hematology, isotopology, bacteriology, or any single area in which the student has a particular interest. 4-week elective periods. Fairfax Hosp.

290 **Extramural Pathology Elective** (arr.) Sidransky
The department arranges for medical students to spend elective periods at other institutions. Interested students should contact the chairman of the department.

295 **Comparative Pathology II** (arr.) Zook, Montali, Jones
Participation in veterinary pathology service, including domestic, wild, and laboratory animals. Graduate students receive five semester hours of credit for each four-week full-time period. Medical students receive five semester hours of credit for each four-week elective period. Prerequisite: Path 201 or 203–4. (Medical students: 4-week elective periods. Path. Lab., Nat'l Zoological Park, and Armed Forces Inst. of Path. Graduate students: Fall or spring)

296 **Surgical Pathology II** (5) Silverberg
Evaluation of surgical specimens and correlation with clinical status of patient; description of gross and microscopic findings on assigned cases. 4-week elective periods. Univ. Hosp.

297 **Dermal Pathology** (5) Graham
Microscopic conferences, review of current material and study sets. 4-week elective periods. Prerequisite: prior arrangement with instructor. Armed Forces Inst. of Path.

298 **Necropsy Pathology** (5) Orenstein
Organ changes in disease, gross and microscopic examinations, preparation of protocols. 4-week elective periods. Univ. Hosp.

299–300 **Thesis Research** (3–3) Staff
(Fall and spring)

301 **Clinical and Anatomical Pathology** (5) B. Smith
(Formerly 291)
Opportunity to explore in depth a topic selected from the field of pathology; library study. 4-week elective periods. V.A. Hosp.

302 **Forensic Pathology** (5) Luke, Blackbourne
(Formerly 294)
Participation in the activities of the office of the Chief Medical Examiner of the District of Columbia. Observation of death scene investigation techniques, medical-legal autopsies, and related toxicological laboratory analyses, attendance at court trials, and participation in the various scheduled conference activities of the agency. 4-week elective periods.

398 **Advanced Reading and Research** (arr.) Staff
Limited to students preparing for the Doctor of Philosophy general examination. May be repeated for credit. (Fall and spring)

399 **Dissertation Research** (arr.) Staff
Limited to Doctor of Philosophy candidates. May be repeated for credit. (Fall and spring)

Pharmacology

Chairman: H.G. Mandel

Professors F.P. Abramson, V.H. Cohn, Jr., P. Klubes, H.G. Mandel, P. Mazel, E. Mikulic *(Visiting)*, J. Seifter *(Research)*, J.A. Straw, J.R. Williams *(Research)*
Professorial Lecturers J. Axelrod, E. Costa, N.H. Neff
Associate Professors R.J. Anderson, P.F. Teychenne
Assistant Professors B.L. Bean, N.A. Brown, K.A. Kennedy

21–22 **Chemistry and Physics of Anesthesia** (3–3) Mazel and Staff
For students in nursing anesthesia. Fundamental concepts of physics, general chemistry, organic chemistry, biochemistry, and their application to medicine and anesthesiology, including chemistry of respiration, acid-base balance, clinical biochemistry and enzymology, hormones, radioisotopes, electronics, physiochemical properties of anesthetic agents, and other related topics. (Academic year)

110–11 **Pharmacological Basis of Anesthesia** (4–4) Mazel and Staff
For students in nursing anesthesia. Fundamental principles of pharmacology; drugs affecting the autonomic nervous system, central nervous system, and cardiovascular system; fundamentals of inhalation anesthesia; auxiliary drugs used in anesthesiology; endocrines, cancer chemotherapy; other topics. (Academic year)

114 **Drugs and the Consumer** (3) Cohn and Staff
General concepts concerning drug action in the body. Mechanism of action of some specific prescription and nonprescription drugs, including contraceptives; tranquilizers and sleep-inducing drugs; hay fever, headache, and cold remedies; analgesics; antibiotics; vitamins. Issues related to development and marketing of drugs, drug safety, drug advertising, generic versus trade-name drugs, drug use in sports, drug use during pregnancy, smoking and health. No science prerequisite required. Limited enrollment. (Fall)

115 **Nonmedical Use of Licit and Illicit Drugs** (3) Cohn and Staff
Psychological and sociological bases of recreational and other nonmedical use of drugs, pharmacological and toxicological aspects of drug action on both the brain and peripheral organ systems, legal and societal implications of and reactions to the nonmedical use of drugs, prevention and treatment of drug dependence. Lectures and discussions on alcohol, narcotics, central nervous system stimulants and depressants, marijuana, hallucinogenic and psychedelic drugs. (Spring)

120 **Readings in Pharmacology for Anesthesia** (arr.) Mazel and Staff
For students in nursing anesthesia. Assigned reading in anesthesia and related areas; preparation of reports.

130 **Seminar: Accessory Drugs in Anesthesia** (2) Mazel and Staff
For students in nursing anesthesia. Presentation of the pharmacology and pharmacodynamics of accessory anesthetic drugs; emphasis on those areas not covered in Phar 110–11.

158 **Pharmacology for New Health Practitioners** (2) Klubes and Staff
For students in allied health programs. Basic pharmacology course. Drug preparations, the basis of their therapeutic and toxic actions and their fate in the body. Prerequisite: HCS 110, 112, Phyl 111.

191 **Respiratory Care** (3) Mazel and Staff
Same as Anes 191. For students in nursing anesthesia. Advanced techniques for care of patients requiring total respiratory support.

195 **Electronics for Medical Personnel** (2) Mazel and Staff
Same as Anes 195. For students in nursing anesthesia. Introduction to fundamental principles used in electronic instrumentation for monitoring patient status in operating room and intensive care unit. Signal conditioning, processing and display techniques, special purpose instruments, safety hazards.

201–2 **Pharmacology** (6–2) Straw and Staff
Required for second-year medical students. Lectures, laboratory, conferences on interaction of drugs and biological systems as a basis for rational therapy of disease. Prerequisite: Bioc 201, Phyl 201, 212.

203 **Fundamental Principles of Pharmacology and Toxicology** (3) Cohn and Staff
Basic principles of pharmacology, including drug-receptor interactions, structure activity relationships, pharmacokinetics, membrane phenomena, cellular control mechanisms, drug toxicity. Admission by permission of instructor. (Fall)

205–6 **Pharmacology** (6–2) Cohn and Staff
For graduate students. Lectures, laboratory, conferences on interaction of drugs and biological systems as a basis for rational therapy of disease. Pharmacodynamics, mechanisms of action, physiological disposition, toxicity, and relative evaluation of drugs. Prerequisite to Phar 205: Bioc 221–22, Phar 203, Phyl 201, 212, or approval of department. Prerequisite to Phar 206: Phar 205. (Fall)

207 **Cardiovascular Pharmacology** (2) Beau
Physiology and pharmacology of cardiovascular diseases, hypertension, heart failure, coronary artery disease, arrhythmia. Mechanism of action of drugs used in the treatment of cardiovascular diseases. Prerequisites: Phys 201 and Phar 201, 203, or 205. (Spring)

215 **Adolescent Drug Abuse** (3) Cohn and Staff
Not open to medical students. Offered off campus primarily for teachers, counselors, and school administrators. Multidisciplinary lectures and discussions concerning the physiological and psychological effects of narcotics, central nervous system stimulants and depressants, alcohol, marijuana, hallucinogenic and psychedelic drugs; psychosocial factors leading to adolescent drug abuse; legal implications of drug abuse; prevention, control, and treatment of drug abuse. (Fall and spring)

220 **Molecular Events in Toxic Actions** (2) Brown and Staff
Metabolism of xenobiotics to cytotoxic products. Environmental and genetic factors influencing toxic actions. Molecular mechanisms of toxicity. Prerequisite: Phar 203. (Spring)

222 **Genetic Toxicology** (2) Williams and Staff
Action of chemicals and radiations in the induction of DNA damage and repair *in vitro* and *in vivo* and the sequelae of these processes in cells and mammals. DNA repair mechanisms, mammalian cell toxicity, mutagenesis and carcinogenesis. Prerequisite: Bioc 221–22. (Fall)

224 **Developmental Toxicology** (2) Brown
Effects of exogenous agents on the processes of reproduction and development and their mechanisms of action. Toxic effects on the gametes, embryo, fetus, and neonate. Prerequisite or concurrent registration: Phar 203, 205. (Fall)

226 **Neurotoxicology** (2) **Anderson**
Mechanisms by which chemicals produce toxic effects on nervous tissue at the subcellular, systemic, and behavioral levels. Effects of chronic and acute exposure. Prerequisite or concurrent registration: Phar 203, 205. (Spring)

230 **Special Topics in Toxicology** (arr.) Staff
Selected aspects of toxicology. Content differs each time course is offered; may be repeated for credit. (Fall and spring)

254 **Frontiers in Pharmacology** (1) **Mazel and Staff**
For medical and graduate students. Recent advances and fields of research in pharmacology. Presentations by laboratory scientists from neighboring institutions. (Spring)

256 **Molecular Pharmacology (2)** **Hahn**
For medical and graduate students. Current theory on action of drugs, especially chemotherapeutic agents, at molecular level. Effect of drugs on biosynthetic processes of the cell with respect to DNA, messenger RNA, transfer RNA, ribosomes, protein, cell wall, and intermediary metabolites. Factors which alter action of drugs, such as drug interactions and resistance. (Spring)

258 **Cancer Chemotherapy** (1) **Mandel and Staff**
For medical and graduate students. Mechanisms by which drugs inhibit the growth of tumor cells. (Spring, even years)

259 **Readings: Cancer Chemotherapy** (2) Klubes and Staff
For medical and graduate students. Selected readings and discussions of recent advances in cancer chemotherapy research. Prerequisite: Phar 201–2 or 205. (Spring, odd years)

260 **Endocrine Pharmacology** (1) Hertz and Staff
For medical and graduate students. Lectures and seminars on recent advances in the pharmacology and mechanism of action of various hormones. (Spring, odd years)

267 **Pharmacological Research** (3) Staff
For graduate students. Research with staff members. May be repeated once for credit toward a Master of Science degree. (Fall and spring)

269 **Pharmacology Seminar** (1) **Mazel and Staff**
For graduate students. Recent advances in pharmacology. Content differs each time the course is offered; may be repeated once for credit. (Fall and spring)

272 **Physiological Disposition of Drugs** (3) **Cohn**
For graduate students. Fate of drugs in biological tissue. Absorption, distribution, chemical alteration, excretion of drugs; physical, chemical, and biological factors affecting these processes. Prerequisite: Phar 201 or 205–6 or permission of instructor. (Spring, even years)

273 **Pharmacokinetics:** Abramson and Staff
Principles and Applications (2)
Compartmental and physiological models of drug disposition. Problem-solving to obtain rate constants, organ clearances, etc., from experimental data. Examples of drug disposition exemplifying various pharmacokinetic approaches. (Spring)

275–76 **Advanced Topics in Pharmacology and Toxicology I–II** (1–1) Anderson and Staff
Lectures and seminars on advances in mechanisms of drug action, pharmacology of new drugs, theoretical aspects of pharmacology, laboratory techniques. (Alternate academic years)

extra-mural speakers. An approved paper required for two semester hour of credit. May be repeated for credit. (Fall and spring)

262 **Topics in Cardiovascular Physiology** (2) Kenne
Survey, at an advanced level, of aspects of cardiovascular physiology, esp cially as interrelated with the respiratory and renal systems. (Fall)

269 **Topics in Neurophysiology and Psychophysiology** (2) Lavin
Selected topics in contemporary neurophysiology, including methods of da collection and analysis, control mechanisms involved in movement and be havior and sensory processing. Admission by permission of instructor (Fall)

270 **Computer Utilization in Physiology and Medicine** (3) C. Tidbal
Lecture one hour per week, practical experience at student's convenience Orientation to digital and analog minicomputers. Programming in severa languages. Experience with one or more computers. No previous compute experience necessary. (Fall)

271 **Computer Simulation of Physiological Processes** (3) C. Tidbal
Programming of physiological simulation will be learned by writing series of simulations of increasing complexity. Prerequisite: Phyl 270 o equivalent, or permission of instructor.

272 **Reading and Research in Simulation of Physiological Processes** (3) C. Tidbal
Readings and discussion on physiological simulations and their evaluation Prerequisite: Phyl 271 or equivalent, or permission of instructor. May be repeated once for credit. Staff

282 **Experimental Physiology** (3 or 5)
Participation in an ongoing research program in the department. Program are currently available in the areas of membrane physiology, intestina transport, neurophysiology, and cardiovascular physiology. 2- or 4-week elective periods. Staff

284 **Advanced Physiology** (3 or 5)
Guided study or laboratory experience at an advanced level in a subfield of physiology. Prior arrangements should be made with the individual faculty member. 2- or 4-week elective periods.

290 **Extramural Physiology Elective** (arr.)
The department arranges for medical students to spend elective periods a other institutions. Interested students should contact the chairman of the department. Staff

295 **Research** (arr.)
By special arrangement with individual staff members. Approximately four clock hours in the laboratory for each semester hour of credit. (Fall and spring) Staff

298 **Comprehensive Physiology** (arr.)
Guided review of selected areas of physiology appropriate to the student's graduate program. This course satisfies the requirements for the Master's Comprehensive Examination, the Field Examination for doctoral students minoring in physiology, and Part I of the Cumulative General Examination. Prerequisite or concurrent registration: Phyl 221. (Fall) Staff

299–300 **Thesis Research** (3–3) Staff
(Fall and spring)

396 **Advanced Reading and Research** (2)
Limited to students preparing for the Doctor of Philosophy general examination. Tutorial literature survey of a subfield of physiology and of pertinent areas of the candidate's minor field. This course satisfies the require-

ment for Part II of the Cumulative General Examination in physiology. **(Fall and spring)**

397 **Development of Dissertation Problem** (2) **Staff**
Limited to students preparing for the Doctor of Philosophy general examination. Preparation for written and oral presentation of dissertation problem. This course satisfies the requirement for Part III of the Cumulative General Examination in physiology. (Fall and spring)

399 **Dissertation Research** (arr.) **Staff**
Limited to Doctor of Philosophy candidates. May be repeated for credit. **(Fall and spring)**

Psychiatry and Behavioral Sciences

Chairman: J.M. Wiener

Professors C.K. Conners, J.H. Egan, R.B. Kurz, J.D. Noshpitz, S. Perlin, J.E. Rankin, D. Reiss, P.J. Steinglass, T.G. Webster, J.M. Wiener, L. Yochelson
Adjunct Professor R.E. Strange
Clinical Professors S. Berman, C.T. Bever, B.S. Brown, R.N. Butler, P. Chodoff, R.M. Coleman, L. Cytryn, C.J. Frederick, K.R. Gaarder, R.D. Gillman, G. Gordon, W.L. Granatir, M.A. Gravitz, J.S. Kafka, M.M. Katz, L.J. King, E.I. Kushner, H.P. Laughlin, B.W. MacLennan, H.A. Meyersburg, T.D. Noble, B. Olshaker, R. Peele, J.L. Rapoport, H.L.P. Resnik, R.E. Rieger, L.D. Robinson, J.G. Rubin, P. Rubovits-Seitz, R.L. Shapiro, M.F. Shore, J. Spurlock, W. Stark, W.J. Stockton, G.R. Ticho, H. Weiner, H.H. Work
Associate Professors J.K. Barber, C.B. Feinstein, B.L. Frankel, M. Hertzman, J.J. McMillan, L.I. Sank, W.H. Scott, S.M. Sotsky, J.H. Wise
Adjunct Associate Professors A.T. Billett, F.K. Millican, R.W. Steyn
Associate Clinical Professors M.T. Advani, L.W. Allen, B.L. Burris, M.J. Chalick, D.C. Choate, J.A.F. Chused, L.R. Conte, R.M. Costell, E.W. Cotlove, D.I. Davis, B.B. Doyle, J.B. Erdmann, J.N. Follansbee, J.A.H. Forgotson, C.H. Frank, J.A. Frank, Jr., M.L. Garrett, M.S. Glatt, S.L. Goodman, S. Gordon, Jr., R.M. Greenberg, S.I. Greenspan, R.L. Gross, M.R. Haas, E.K. Herz, J.H. Herzberg, F.G. Hilkert, H.A. Hoffman, J.A. Huntzinger, W.C. Johnson, D.I. Joseph, I.H. Kaiser, K.L. Kaplan, J.J. Katzow, K.A. Kessler, H.B. Lehrman, L.D. Levi, E.J. Lieberman, S.H. Lipsius, T.M. Mackenzie, J.R.S. Malkin, A.E. Marans, I.H. Marill, J.E. Meeks, J.H. Menetrez, I.D. Milowe, S.R. Palombo, D.Y. Patterson, J.M. Post, J.T. Quattlebaum, R.A. Ratner, K. Ravenscroft, Jr., C.B. Robinowitz, M.E. Robinson, R.A. Rogers, S. Rosenblum, S.A. Savitz, G. Scarcella, N.A. Schweig, J.L. Sheridan, M.R. Skolnick, J.H. Smith, M.J. Stern, B.C. Straight, W.F. Thompson, D.L. Tippett, G.A. Tripp, H.J. Wain, J.P. Waletzky, A.F. Ward, Jr., P.S. Weisberg, S.M. Weissman, R.E. Wittenberg, S.J. Wolin, P.G. Yessler, I.M. Zimmerman, J. Zinner
Associate Professorial Lecturer M. Engel
Assistant Professors L.A.M. Bennett *(Research)*, M.A. Borengasser, B.A. Copeland, J.L. Gaiter, N.M. Horstmann, R.L. Jenkins, A.B. Livingood, M.E.P.

Oliveri *(Research)*, E.M. Plionis *(Research)*, T.M. Richards *(Research)*, C.N. Rogers, C.S. Shaffer, J.R. Shapiro, L.A. Vitulano, K.C. Wells

Adjunct Assistant Professors L.H. Haller, J.A. Jay, R.S. Richmond, S.E. Samenow, A.H. Taub

Assistant Clinical Professors S.L. Aledort, R.G. Ammerman, B.S. Arons, W.E. Barquist, E.C. Bergman, S.L. Billett, J.H. Bouma, M. Boverman, C.V. Cabrera, D.L. Charney, C.T. Chastek, J.C. Chatel, I.M. Chatoor-Kos J.M. Chertoff, M.M. Clancy, W.F. Conger, L.A. Cove, G.P. Davis, I. Dos vitz, L.S. Dworsky, R.C. Eisner, J.L. Evans, N.S. Ferebee, D.H. Fram, R. Frank, S.L. Friedman, G.P. Gabe, D.J. Gardner, R.J. Garson, R.B. Gerbe D.R. Glass, Jr., M.R. Goldberger, K.P. Gorelick, B.C. Gorman, R. Greenberg, C.D. Hanson, S.A. Hassan, N.B. Heller, S.G. Hershberg, K.H Huang, B.P. Jones, J.A. Jurand, R. Kayton, R.W. Keisling, R.A. King, J.E Kleinman, G.F. Kolodner, B.L. Kraff, P.D. Kramer, L.E. Kreuz, B.J Landau, P.A. Lange, D.A. Lanham, B.E.S. Lawrence, P.D. Leber, G.D Legler, R.T. Lewit, D.G. Lipman, R.J. Loewenstein, T.J. Lustberg, J.R Maloney, P. Mardelli, C.I. Margolis, B.P. McKaig, D.H. McKnew, Jr., H.M Meagher, E.S. Meid, W.B. Mendelson, G.H. Miller, A.B. Molchon, D.T Mosher, P.F. Namrow, R.A. Nover, J.A. Nowak, A. Olaciregui, R.R Palmer, S.R. Pieczenik, H.A. Pincus, D. Pope, V.E. Powell, J.W. R-Love J.L. Read, H.W. Rice, K.C. Rickler, R. Rubovits-Seitz, A.R. Sager, A.J Salerian, A.H. Sandler, P.J. Santora, G. Schaeffer, D.E. Scharff, J.A. Schoet ler, G.W. Schwarcz, C. Schwarzbeck, J.R. Sealy, B.M. Smoller, E. Sore E.A. Sorrentino, G.J. Soverow, J.L. Speller, A.H. Stein, H. Steinberg, P.J Steinberg, F. Strassburger, E.S. Taylor, C.C. Titus, L. Turner, M.L. Usher R.W. Wadeson, Jr., D.R. Weinberger, J.L. Wellhouse, N.L. Wilson, A.B Zients, D.M. Zwerdling

Assistant Professorial Lecturer A. Zappala

Adjunct Instructors N.B. Delston, E.K. Wolf

Clinical Instructors W.L. Anixter, J. Bloom-Feshbach, M.W. Gross, M.M. Herenda, F.L. Kolodner, D.M. Lewis, J.E. Lincoln, R.B. Lott, K.L. Owens G.P. Perman, N. Sacirbey, M.M. Schwartz, S.W. Skoler, T.A. Teplitz, N Tonesk

Special Lecturers S.P. Levi, R.L. Siegel

All clinical courses are five credit hours per four-week period.

250 **Individual Student Preceptorship** (1) Hendren and Staff
First- and second-year medical students can arrange individual preceptor ships other than departmental electives listed below with the permission of the chairman of the department.

*252 **Psychological and Social Factors of Medical Practice** (1) Barber and Staff
Basic principles of the doctor-patient relationship. Analysis of psychological growth and development, family process, and the personality of the physician as they influence everyday medical practice.

*301 **Psychopathology and Conceptual Models** (3) Wiener and Staff
For second-year medical students. Mental mechanisms, psychopathology, introduction to psychiatric syndromes, clinical interviewing, behavioral sciences in clinical medicine. (Fall)

* Required for medical students.

*302 **Clinical Clerkship** (10) Webster and Staff
Supervised examination, diagnosis, outpatient and inpatient treatment at University, St. Elizabeths, Children's, and Washington V.A. Hospitals, and Psychiatric Institute. Case conferences, seminars on psychiatric referral, "psychiatric" drugs, community resources. Psychiatry in general practice stressed. (Fall and spring)

353 **Basic Psychoanalytic Concepts: Clinical Illustrations** (1) Wiener
Basic psychoanalytic concepts such as dreams, transference phenomena, and the various components of personality structure. Participation in discussions focusing on psychoanalytic issues and the relevance of such concepts to the practice of medicine in general. For first- or second-year medical students. (Eight two-hour sessions)

381 **Clinical Psychiatry** (5) Hertzman, Sotsky, Frankel, Hendren
Student performs as acting intern in one or more of the psychiatry services of GWU Medical Center: inpatient and emergency (Hertzman), outpatient (Sotsky, Hendren), and consultation-liaison (Frankel). Assignments are based on student preference within limits of feasibility for the elective period involved. At least eight weeks preferable for supervised psychotherapy experience. Four-week elective emphasizes diagnostic assessment and briefer treatment modalities. 4-week elective periods.

383 **Psychological Aspects of Medical Illness and Care** (5) Frankel
Student participates in an individualized program on the consultation-liaison service with emphasis on the psychosocial factors affecting the onset, manifestations, and treatment of medical illness. Program includes involvement in consultation process, conferences, liaison meetings, individual supervision of clinical work, and readings in the literature. 4-week elective periods.

384 **Outpatient Psychiatry** (10) Sotsky, Hendren
Student participates as acting intern in multidisciplinary outpatient clinic team with experiences in diagnostic assessment, crisis intervention, pharmacotherapy; supervision of clinical work and readings in field; participation in clinical case conferences, assessment conferences, and relevant resident seminars. 8-week elective periods.

387 **Family Research** (10) Reiss and Staff
Student participates in family research. Individualized student selection and program by arrangement. Student will do own project with individual supervision. Supervised individual readings and work. 8-week elective periods.

388 **Child and Adolescent Psychiatry** (5) Egan and Child Psychiatry Faculty
Student performs as acting intern in child psychiatry. A specialized elective in consultation to pediatric wards, outpatient evaluation and treatment of selected child patients and their families, and/or inpatient child and adolescent services. Eight weeks required for specialized experience in all three areas. Individualized program by arrangement. Assignments based on student's preference and prior experience, within limits of feasibility for elective period involved. 4-week elective periods. Children's Hosp.

390 **Extramural Psychiatry Elective** (arr.)
The department may arrange for students to spend one or more elective periods at other institutions. Information on electives at other

* Required for medical students.

medical schools available. Possibilities include working in NIH laborator in adult or pediatric psychopharmacology. 4–8-week elective periods.

397 **Schizophrenic and Borderline Conditions** (5) Ehlers, Bullard*
Student participates in, observes, and studies treatment and administra tive management of patients. Participates in staff meetings. Individu supervision and selected readings. 4-week elective periods. Chestn Lodge, Rockville, Md.

404 **Clinical Research and Psychopharmacology** (5) Goodwin and Staf
Student participates in clinical research at the Clinical Psychobiology Branch, NIMH, which conducts a research and treatment program in depression and manic-depressive disorders. Facilities include inpatien ward, outpatient department, and biochemical laboratories. Student work on an individualized component of a major research project with direc supervision by a research psychiatrist. Participation in clinical confe ences, didactic lecture series, research conferences, and planning meetings 4-week elective periods.

406 **Psychiatric Education, Research, and Administration** (5) Robinowitz and Staf
Student preceptorship: practicum experience, theoretical instruction, par ticipation in research, and individual project. Direct supervision and close working contact with director and staff, office of education of nationa specialty society. Opportunity to observe operations and for contacts with leaders in field. Student gains knowledge of research and administration pertaining to women in medicine, psychiatric education, manpower, de velopment relevant to health care delivery, continuing education, federa and legislative affairs, health planning, and relation of medical educatio to practice. Personal interview required to plan individualized program 4-week elective periods. American Psychiatric Association.

409 **Independent Studies** (5) Hendren
Individualized studies, clinical training, or research experience. Selection on basis of student interest, personal interview, and available resources. Possible subjects may include death and dying, suicide, medical ethics depression, or other psychiatry and behavioral science interests of the student and available faculty. 4-week elective periods.

411 **Introduction to Clinical Psychiatry** (2) Wiener, Barber, Perlin, Hendren
(Formerly Group Therapy; 1 credit)
Students will join staff member during evaluations and consultations as well as discussions of readings of interest in general psychiatry. Course exposes students to inpatient, outpatient, emergency room, and consulta tion liaison psychiatry. Kaiser

412 **Application of Psychoanalytic Principles to the Practice of Medicine** (1)
(Formerly Mental Health Issues for Deaf People)
Special course designed for medical students by Extension Division of the Washington, D.C., Psychoanalytic Institute, taught by a practicing psychoanalyst on our clinical faculty. 2–3-week advance notice required to arrange for an instructor. Robinowitz

413 **Identity and Role of the Physician** (1)
(Formerly Autobiographical and Fictional Accounts of Madness)
Emphasis on the role and identity of the physician (with special emphasis on women). This would be done in a small group in which didactic ma terial on the role and identity of the physician would be combined with

* Dr. Bullard is Senior Consultant at Chestnut Lodge.

more experiential models, including group dynamics. Number and time of meetings flexible.

414 **History of Mental Illness and Therapeutics** (1) Gorelick
Consideration of the historical periods of primitive healing, Greek medicine, Arabic medicine, Christian healing, witchcraft, and key developments of the last 200 years. Student may select topic of particular interest for further study with supervisor.

415 **Individual Student Preceptorship** (1) Hendren and Staff
(Formerly Identity and Role of the Physician)
First- and second-year medical students can arrange individual preceptorships other than departmental electives listed with the permission of Dr. Hendren.

419 **Seminar: Special Topics and Techniques in Family Psychotherapy** (3) Steinglass
Advanced seminar for family therapists. The concept of the family life cycle will be used as a framework for identifying specific developmental phases in family life. Marital therapy, family therapy with young children, sexual dysfunction, divorce, occupational crises, retirement. Phase-specific problems and specialized intervention techniques. Participants must be currently seeing families in therapy. Permission of instructor(s) required.

420 **Research Methods for the Direct Study of the Family** (3) Reiss
Basic concepts in the design of quantitative studies of the development and function of the family. Topics to be covered include the use of theory, grounded observations, and personal experience in the design of research; analyses of verbal interaction; social systems analyses; a comparative analysis of interview methods, laboratory procedures, and naturalistic observations. Prerequisite: permission of instructor. (Fall)

Radiology*

Chairman: D.O. Davis

Directors of Divisions: W.W. Olmsted, R.C. Reba *(Nuclear Medicine)*, D.J. Goodenough *(Radiation Physics)*, C.C. Rogers *(Radiation Oncology and Biophysics)*

Professors E.W. Bradley *(Research)*, D.O. Davis, W.C. Eckelman *(Nuclear Medicine)*, A.M. Lewicki, M. Majd, W.J. McSweeney, W.W. Olmsted, R.C. Reba *(Nuclear Medicine)*, S.D. Rockoff, C.C. Rogers *(Radiation Oncology)*, W.J. Rzeszotarski *(Research—Nuclear Medicine)*, B.J.L. Sauerbrunn *(Nuclear Medicine)*, V.M. Varma *(Nuclear Medicine)*, W.A. Volkert *(Visiting Research)*, J.R. Williams *(Research)*

Clinical Professors R.M. Allman, G.J. Augustin, C.V. Cimmino, J.L. Doppman, B.T. Katzen, J.M. Korsower, J.G. Maier *(Radiation Oncology)*, J.J. Smith *(Nuclear Medicine)*, A.C. Wyman

Professorial Lecturers S.L. Brahman, J.E. Lichtenstein, J.E. Madewell

* Unless otherwise indicated, all faculty appointments are in the Diagnostic Radiology division.

Associate Professors S.C. Carabell, E.M. Druy, J.W. Gaskill *(Research)*, R.E. Gibson *(Research)*, D.J. Goodenough *(Radiation Physics)*, R.E. Johnsonbaugh, C.C. Ling, C.H. Paik *(Research—Nuclear Medicine)*, B.M. Potter

Adjunct Associate Professors W.J. Bunnell, J.A. Deye *(Radiation Physics)*, D. Kram

Associate Clinical Professors P.F. Abraham, L.D. Brotman, J.A. Burwell, C.M. Citrin, L.M. Glassman, J.K. Hutcheson, E.R. Jacobs, E.V. Kotlyarov, S.N. Lee, R.J. Lull, J.D. Marriott, D.D. Maxwell, S. Mittler, C.F. Murphy, W. Nelson, N.G. Nolan *(Nuclear Medicine)*, B.E. Rubin, M.A. Weiss, E.E. Westura

Associate Professorial Lecturers A.C. Brower, D.J. Curtis, J.A. Long, Jr.

Assistant Professors J.A. Becker, D.R. Brallier, T.C. Fearon, C.A. Finder, A.N. Gulati, R.F. Kiepfer *(Nuclear Medicine)*, S.M. Levenson *(Research)*, B.M. Markle, J.I. Rich, A.J. Roach, S.N. Rustgi, P. Shapiro *(Research)*, M. Sobel *(Research)*, K.E. Weaver *(Radiation Physics)*

Adjunct Assistant Professors F.B. Atkins, E.J. Banasiak, L.W. Busching, A. Castagnolo, M.L. Cianci, W.H. Farland, D.A. Marden, N.L. McElroy, C.E. Pickwick, M.H. Selikson *(Radiation Physics)*

Assistant Clinical Professors J.B. Bowers, B.G. Brotman, S.R. Brown, D.R. Buck, A.S. Cigtay, M.D.M. Faris, R.S. Frankel, N. Ghaed *(Nuclear Medicine)*, D.S. Hartman, H.W. Henry, K. Horvath-Pushkas, E.R. Lipsit, A.L. Moniot *(Nuclear Medicine Technology)*, S.M. Perl, R.S. Pyatt, Jr., K.G. Rieth, M. Rosenstein *(Radiation Physics)*, G.S. Staples, M.A. Thomas, A.L. Tievsky, G. Tievsky, D. Van Nostrand, W.D. Wehunt, Z.R. Weinstein, L. Wener, R.L. White, J.W. Winebright *(Nuclear Medicine Technology)*, M.G. Wolfman, K.S. Yingling

Assistant Professorial Lecturer A.C. Friedman

Adjunct Instructors T.R. Fewell, G.E. Flook, M.A. Goelz, R.W. Killian, T.E. Lewis, B.R. Rock, L.W. Treadwell, Jr., E.H. Whittemore

Clinical Instructor J.L. Murray

Special Lecturers J.H. Coenen *(Nuclear Medicine Technology)*, D.L. Daniels *(Nuclear Medicine Technology)*, R.P. Franco, K.G. Norwood, T.A. Peters *(Nuclear Medicine Technology)*, J.A. Stickland, M.T. West

Courses numbered 40 through 190 are limited to students in the Associate in Science and Bachelor of Science degree programs in radiologic technology, nuclear medicine, and radiologic science and administration.

40 Clinical Training and Experience in X-ray Technology I (2) Gerber, Marriott
Instruction and close supervision in the use of radiologic techniques to examine the digestive, urinary, female reproductive, central nervous, and circulatory systems; chest and abdomen radiography, orthopaedic radiography, ENT and neurologic radiography, portable radiographic examinations, pediatric radiography, nuclear medicine, radiation therapy.

41 Clinical Training and Experience in X-ray Technology II (2) Gerber, Marriott
Prerequisite: Rad 40.

42 Clinical Training and Experience in X-ray Technology III (2) Gerber, Marriott
Prerequisite: Rad 40, 41.

43 **Clinical Experience in Nuclear Medicine I** (4) Reba and Staff
Practical study and supervised performance; emphasis on indications and contraindications, procedures and methods, physiological and procedural factors which may result in a false study, radiation safety techniques, preparation and development of new radiopharmaceuticals and research methodology, and administrative procedures.

44 **Clinical Experience in Nuclear Medicine II** (5) Reba
Prerequisite: Rad 43.

50 **Radiologic Anatomy I** (4) Rock and Staff
Human anatomy as applied to radiologic terminology. Structure and function of the human skeleton and topographical anatomy, both normal and pathological.

51 **Radiologic Anatomy II** (4) Rock and Staff
Human anatomy as applied to radiographic procedures. Structural and functional approach, application to radiography of the digestive, respiratory, excretory, endocrine, reproductive, and nervous systems and the organs of special sense. Some discussion of medical and surgical diseases. Prerequisite: Rad 50.

55 **Stationary and Rectilinear Imaging** (3) Peters
Related anatomy, physiology, and pathology of imaging procedures; basic methodology of these and related procedures, including bone, brain, liver, liver function, bone marrow, lung, liver-lung, transmission, cardiac blood pool, cisternography, spleen, parathyroid, pancreas, lung ventilation, parotid ventriculography; miscellaneous scans; brain and cardiac flow studies.

56 **Hematologic and Radionuclide Dilution Procedures** (3) Peters and Staff
Related anatomy, physiology, and pathology of hematologic and radionuclide dilution procedures; basic protocol for these procedures, including plasma volume and related plasma studies, red cell volume and related red cell studies, studies of iron metabolism, and the placental localization and scanning.

57 **Organ Concentration-Excretion Measurements** (3) Staff
Related anatomy, physiology, and pathology of organ concentration-excretion measurements; the procedure for those measurements, including thyroid uptake and its variations, thyroid scan, metastatic chest survey, renogram, renal scan, and renal flow study.

58 **Gastrointestinal Absorption Measurements** (1) Williams
Related anatomy, physiology, and pathology of gastrointestinal absorption measurements; the procedure for those measurements, including fat absorption studies (triolein and oleic acid) and the three stages of the vitamin B-12 absorption study (Schilling test).

59 **Competitive Binding Radioimmunoassay** (2) Williams
Basic concepts of radioassay; basic procedure for any competitive binding radioassay. Specific concepts and procedure for T3, T4, and serum B-12 determinations; factors affecting those determinations and the interpretation of their results.

60 **Radiographic Technique I** (4) Stickland and Staff
Theoretical and practical study of x-ray machines, equipment, patient positioning, and radiographic qualities; history and development of x-ray, phototiming, x-ray tubes, and Bucky grids and their uses; anatomical landmarks, radiographic terminology, exposure factors, and variations; radiographic calibration (quality and quantity); marking of films and factors governing good film quality. Laboratory work.

61 **Radiographic Technique II** (4) Stickland and Staff
Preparation of exposure charts and use of radiation protection devices, practical applications of technical uses of stationary and portable equipment under supervision, techniques for pediatric radiographs and methods of positioning and restriction, intra-oral radiography techniques. Photofluorographic chest units, departmental floor plans, basic office procedures. Laboratory work. Prerequisite: Rad 60.

62 **Darkroom Technology** (3) Killian, Ethridge
Processing of film after exposure; care and handling of conventional and automatic darkroom equipment; types of film, handling and storage; mixing and handling of chemicals and the action and quantity of these chemicals in the processing of film; effects of heat and cold on these chemicals, diagnosing of various improper developing techniques. Laboratory work.

65 **Basic Chemistry** (3) Williams
Introduction to basic chemistry: kinds of matter, atomic structure, the periodic table, chemical bonding, formulae and equations, solutions, acid-base reactions; introduction to organic chemistry and biochemistry; laboratory sessions.

66 **Radiopharmaceuticals** (3) Staff
Uses of radionuclides in medicine, basic principles of a Mo-99/Tc-99m generator, radiopharmaceuticals and their action within the body, preparation of radiopharmaceuticals using generator-produced nuclides, quality control, accountability, procurement, clinical orientation.

70 **Radiographic Physics I** (4) West, Goelz
Fundamental concepts of physics, including standards of measure, metric measurement, laws of motion, weight, work, power, energy, and momentum. Introduction to structure of matter, atomic and nuclear structure, periodic tables, chemical bonding, material and artificial radioactivity, series decay. Description and use of electrostatics and magnetism. Laboratory work.

71 **Radiographic Physics II** (4) West, Treadwell
Fundamental concepts of current flow, ohms and Joule's law, series/parallel, compound circuits, battery types and functions, metering devices, electrical safety. Description and function of electromagnetism and induction, alternating current principles, AC cycle, induction and inductor, capacitance and capacitors, applications of electronic principles to x-ray equipment and components; transformers, generators, motors, rectifiers, current control devices, fuses, circuit breakers, magnetic relays, circuitry of fixed and mobile x-ray units. Laboratory work.

72 **Radiation Instrumentation** (5) Peters and Staff
Theoretical and practical aspects of radiation detectors; types, components, and operation of detectors; collimators; geometry; introduction to rectilinear scanning; introduction to stationary imaging; clinical orientation.

75 **Fundamentals of Atomic and Nuclear Physics** (3) Staff
Basic units, quantum theory, Bohr theory, atomic and nuclear structure, radioactivity and decay, alpha and beta particles, electromagnetic radiation, series decay, radioactive equilibrium, I.C.R.U.

80 **Mathematics of Radiology** (3) Killian and Staff
Principles of mathematics as applicable to the physics of radiologic technology; use of logarithms, including multiplication, division, powers, and roots; scientific notation; geometry of the circle, square, and rectangle; basic trigonometric functions; linear equations in the unknown; Cartesian coordinate plane; slope of straight line; linear equations from given condi-

tions; and graphic solution of two or more linear equations. For off-campus students only.

81 **Basic Mathematics** (3) Peters
Review of basic high school mathematics, basic algebra, common and natural logarithms and their manipulation, linear and logarithmic graphing, and manipulation of a log-log slide rule.

82 **Applied Technical Mathematics** (3) Peters
Mathematics as applicable to nuclear medicine. Basic decay formula and its variations, calculation of doses of radionuclides, basic statistics terminology, frequency distributions, confidence limits, standard error, efficient distribution of counting time, statistics relating to rectilinear and stationary imaging.

90 **Medical Ethics** (1) Staff
Ethics of physician/technician/patient relationships. Responsibilities, both moral and legal, to physician and patient; the rapport expected of the technologist.

91 **Special Projects in Radiology** (arr.) Staff
Independent study on an aspect of radiology worked out between the student and the instructor.

92 **Mathematics of Radiology** (3) Gaskill
(Formerly Basic Physics)
Principles of mathematics as applicable to physics of radiologic technology; use of exponential and logarithm function, including multiplication, division, powers, and roots; scientific notation; geometry of the circle, square, and rectangle; basic trigonometric functions, linear equations in the unknown; Cartesian coordinate plane; slope of straight line; and linear equations from given conditions. Usage and application of calculators is stressed. Prerequisite: admission into radiological sciences undergraduate or graduate program.

93 **Radiobiology and Radiation Dosimetry** (3) Staff
Interaction of radiation with matter; radiation effects on molecular, cellular, tissue, and organ levels; genetic and somatic effects of ionizing radiation; classical and M.I.R.D. methods of absorbed dose calculation.

94 **Radiological Safety** (3) Staff
Introduction to radiation safety; units of radiation exposure and dose; licensing; NRC regulations; accountability and records, receipt, storage, handling, transportation, and disposal of radioactive materials; monitoring; shielding; dose-distance relationships; personnel dosimetry; radiation illness; radiac instruments; radiation safety clothing; radioactive "spill" procedure.

95 **Radiation Safety** (3) Staff
Radiation tolerance, safety, and reporting photodosimetry; protective methods, control devices, shielding, half-life, detection, detection equipment, design and operation, thermoluminescence (its operation and uses), terminology and subject matter. Laboratory work.

96 **Radiation Biology and Survey of Radiation Therapy** (3) Stickland
Effects of ionizing radiation on various cells, tissues, organs, and the human body as a whole; organic and inorganic molecules; the human immunity system; effects on pregnancy and relative radiosensitivity of the developing embryo; possible genetic effects of radiation; chronic and acute effects of radiation; use and history of radiation in therapy; classification of neoplasms, types of therapy units, and treatments. Prerequisite: Rad 50, 70, 71

97 **Special Procedures** (3) Staff
Techniques of radiology employing contrast media. Fluoroscopy, spot films, body section radiography, pelvimetry, placentography, location of foreign bodies in the eye, angiography, O.R. techniques, oral procedures, stereoscopy, pediatric angiographic procedures. Prerequisite: Rad 61, 71.

98 **Therapy Procedures** (1) Staff
Introduction to radiation therapy and radium implants. Related anatomy, physiology, and pathology of phosphorous–32 and iodine–131 therapies and the technologist's responsibilities concerning them.

99 **Alternate Imaging Systems** (3) Jones
Various modalities of radiographic imaging systems: types of equipment and design. Intensifying screens, fluoroscopy, spot filming, image intensification, cinefluoroscopy, film changers, reproduction, polaroid imaging, thermography, ultrasound, electron radiography, computerized axial tomography, principles of nuclear medicine. Prerequisite: Rad 60, 71, and 95.

140 **Radiology Administration** (4) Becker
Key areas of administration; human skills, technical skills, and conceptual awareness as they pertain to radiologic management at the department level. Traditional management concepts and models developed through modern texts and current journals which address the topics of organizational behavior, planning, controlling, etc. Discussion and exploration of the logistics of managing a radiology section. Prerequisite: HCS 142, 153, 154, 170.

145 **Administrative Project: Diagnostic Radiology** (3) Becker
For students concentrating in diagnostic radiology. Students identify, develop, and complete a project for a radiology department using administrative principles. Weekly seminars include current issues in management and leadership. To be taken with Rad 140.

147 **Administrative Project: Nuclear Medicine** (3) Becker
For students concentrating in nuclear medicine. Students identify, develop, and complete a project for a nuclear medicine department using administrative principles. Weekly seminars include current issues in management and leadership. To be taken with Rad 140.

149 **Administrative Project: Radiation Therapy** (3) Becker
For students concentrating in radiation therapy. Students identify, develop, and complete a project for a radiation therapy department using administrative principles. Weekly seminars include current issues in management and leadership. To be taken with Rad 140.

167 **Radiation Physics and Safety I** (3) Weaver and Rosenstein
Concepts of matter and energy and electromagnetic radiation. Mechanisms in the production of x-rays and x-ray circuits, including half-wave and full-wave rectification and three-phase generators. Interaction of radiation with matter, emphasizing the photoelectric, Compton, and pair-production effect. Radiation detection and dosimetry, Roentgen rad and rem units of radiation. Radiation safety as applied to diagnostic radiology, nuclear medicine, and radiotherapy, including effects of time, distance, and shielding. Maximum permissible concentrations, internal dose problems. Prerequisite: Rad 92.

171 **Radiological Electronics and Engineering** (3) McElroy
Introduction to basic electronics and the operation, limitation, use, and principles in the selection of instrumentation. Transistors, power supplies, amplifiers, major circuit components of radiation detection instruments, gamma camera and rectilinear scanners, radiotherapy orthovoltage and

linear accelerators, and diagnostic radiography equipment. Prerequisite: Rad 92.

175 **Physics and Radiological Imaging** (3) Weaver
For students concentrating in diagnostic radiology. Image formation and transmission through radiological and related photo-optical devices, utilizing system analysis techniques. Concepts of sensitivity, contrast, and modulation transfer functions. Description and analysis of photo receptors, including film grids and Bucky and intensifier screens. Radiographic development process. Fluoroscopy, cine radiography, and video techniques; image storage electronic radiography; and solid state imaging panels. Ultra sonography and thermography. Demonstrations and experiments in control and evaluation of radiologic imaging. Prerequisite: Rad 167.

176 **Physics of Nuclear Medicine** (3) Weaver
For students concentrating in nuclear medicine. Concepts of radioactivity, including beta decay, isomeric transitions, electron capture, internal transition, alpha decay, and the auger effect. Isotopic half-life secular and transient equilibrium. Artificial transmutations, nuclear reactions, counting statistics, and selection of instrumentation. Scintillation spectrometry techniques. Rectilinear scanners, gamma camera, and computer technology in nuclear medicine. Demonstrations and experiments in control and evaluation of imaging. Prerequisite: Rad 167.

177 **Dosimetry in Radiation Therapy** (3) Ling
For students concentrating in radiotherapy. Concepts of depth dose, isodose curves, and tissue air ratios for different energies, TSD, and field size. Techniques of treatment planning for stationary, multiple, and moving portals for Co-60 and megavoltage linear accelerators. Concepts of wedge fields and compensation for multiple TSD surfaces and tissue inhomogeneities. Dosimetry of linear sources. Quimby and Paterson Parker dosimetry systems. Computer techniques in radiotherapy. Introduction to the dosimetry of electrons, neutrons, and the heavy particles. Demonstrations and experiments illustrating dosimetric principles. Prerequisite: Rad 167.

190 **Biological Aspects of Radiation** (2) Becker and Staff
(Formerly Radiobiology)
Chemical, physical, and genetic effects of cells and organisms. Radioecology, safety, health, and legal aspects of control are covered. Prerequisite: admission into radiological sciences undergraduate or graduate program.

195 **Directed Study in Radiation Physics** (2) Weaver
Projects in selected specialty demonstrating applications of radiation physics, imaging, or dosimetric principles to radiographic quality control and evaluation of radiological equipment systems. Prerequisite: Rad 167; 171; 175 or 176 or 177.

383 **Clinical Radiology** (5) Wyman and Staff
Radiologic and differential diagnosis with specific emphasis on the role of diagnostic radiology in clinical problem-solving. Each student is assigned a patient population in Medicine and Surgery, and correlates radiologic examinations with clinical manifestations of disease. Brief clinical and radiological summaries on patients may be required. Procedures, case conferences with staff members, and interaction with medical and surgical staff. Daily lectures and departmental staff conferences. ACR Learning File and audio visual material. 4-week elective periods. Univ. Hosp.

384 **Diagnostic Radiology** (5) Burwell and Staff
Participation in general radiography, fluoroscopy, and special procedures; interpretation of radiologic procedures with staff; review and study of teach-

ing film file. Attendance at medical, surgical, and pediatric staff conferences. 4-week elective periods. Fairfax Hosp.

385 **Nuclear Medicine** (5) Reba and Staff
Introduction to the application of radiotracer techniques in clinical medicine and biomedical research. Students may participate as clinical nuclear medicine interns or as research assistants. All students are encouraged to become involved with one of the research projects of the division or in an original project of their own, utilizing radiotracer techniques in an independent investigation oriented toward pharmaceutical chemistry, computer applications, or patient care. 4-week elective periods. Univ. Hosp.

386 **Radiation Oncology** (5) Rogers and Staff
Introduction to high-energy radiation and principles in radiation biology. Participation in management of patients with a variety of malignant diseases by radiotherapeutic techniques with emphasis on diagnosis and prognosis. Correlative assigned reading and seminars. 4-week elective periods. Univ. Hosp.

387 **Subspecialty Diagnostic Radiology** (5) Wyman and Staff
Subspecialty training in radiological diagnosis to prepare students for specialty medical training. Offerings include pulmonary, gastrointestinal, urologic, obstetric and gynecologic, neurologic, and pediatric subspecialties. Prerequisite: permission of department. 4-week elective periods. Univ. Hosp.

389 **Diagnostic Radiology** (5) Staff
General radiography, fluoroscopy and nuclear medicine, special procedures, ultrasound, and/or CT. Review and study of teaching image file. 4-week elective periods. Nat'l Naval Med. Center.

390 **Extramural Radiology Elective** (arr.)
Participation in a radiology program at another institution, dependent on written acceptance of the student by the chairman of the extramural Department of Radiology and with confirmation by the Educational Director, Department of Radiology, G.W.U. Medical Center.

400 **Diagnostic Radiology** (5) Augustin and Staff
Same as Rad 389 4-week elective periods. Wash. Hosp. Center.

401 **Diagnostic Radiology** (5) Wyman
Participation in general radiologic interpretation, nuclear radiology, special procedures, ultrasound, and CT. Review and study of teaching file. Daily conferences. 4-week elective periods. Walter Reed Army Med. Center.

Surgery

Acting Chairman: N.T. Tsangaris

Directors of Divisions: B L. Aaron *(Thoracic and Cardiovascular Surgery)*, P.E Shorb, Jr. *(General Surgery)*, J.G. Randolph *(Pediatric Surgey)*, S.D. Macht *(Plastic Surgery)*, J.M. Gitelman *(Oral Surgery)*

Professors L.T. Bowles, G.A. Higgins, Jr., G.S. Letterman *(Plastic Surgery)*, J.G. Randolph, P.E. Shorb, Jr., N.T. Tsangaris

Clinical Professors W.J. Fouty, N.H. Isaacson, M. Mills, J.R. Thistlethwaite

Professorial Lecturer C.O. Callender

Associate Professors B.L. Aaron, T.C. Alford, K.D. Anderson, G.W. Geelhoed, J.M. Giordano, S.A. Karmi, F.M. Midgley, H.C. Pierpont, S.A. Rosenberg, L.W. Thompson, H.H. Trout III

Associate Clinical Professors F.B. Brandt, J.W. Canter, P.J. Corso, J.M. Keshishian, S.M. Kirson, M.A. Schurter, C.A. Silva, N.P.D. Smyth

Associate Professorial Lecturer L.E. Church *(Oral Surgery)*

Assistant Professors R.C. Cochran, M.R. Eichelberger, J.R. Fletcher, K.M. Grundfast, S.D. Macht, C.A. Peck, Jr., S.D. Pett, L.E. Smith, D.C. Watson, Jr.

Assistant Clinical Professors E.J. Alpher, J.R. Appleton, R.R. Cameron, M.H. Cohen, S.G. Crossland, R.L. Flax, B.F. Frankel *(Oral Surgery)*, J.M. Garcia, J.M. Gitelman *(Oral Surgery)*, L.W. Gray, Jr., E.D. Hanowell, I. Harrison, M.H. Jordan, S.M. Knoll, L. Kozloff, R.D. Kurstin, B.J. Levin, C.L. Magassy *(Plastic Surgery)*, J.J. O'Connor, N.A. Odyniec, L.R. Perna, J.F. Schanno, B.S. Teunis, P. Zamick *(Plastic Surgery)*

Adjunct Instructors P.H.J. Krogh, C.C. Lindquist

Clinical Instructors K.F. Cheyney, P.J. Galipeau, D.R. Gens, S. Holen *(Periodontics)*, G. Rothman, J.H. Sager, C.J. Schaefer, R.S. Siegel *(Oral Surgery)*, J.A. Walsh

Special Lecturers J.H. Bayly, R.N. Scott

302 **Clinical Clerkship in Plastic Surgery** (3) Staff
Two-week elective periods. Univ. Hosp.

*303 **Clinical Clerkship** (10) Staff
Eight weeks at Univ. Hosp. and Nat'l Naval Med. Center.

376 **Advanced Surgery** (5) Staff
Participation in total patient care, including operative procedures under close supervision. 4-week elective periods arranged at affiliated hospitals.

378 **Intensive Care Unit** (5) Fouty
Introduction to the management of acutely ill surgical patients, including cases involving trauma; neurosurgery; and cardiovascular-thoracic, abdominal, and orthopaedic surgery. 4-week elective periods. Wash. Hosp. Center.

379 **Transplantation Immunology** (5) Geelhoed
Clinical renal transplantation and preservation. Daily teaching rounds, literature conference, seminar presentation, weekly surgical-medical nephrology rounds. 4-week elective periods. Univ. Hosp.

382 **Hand and General Plastic Surgery** (5) Thompson
Participation in total patient care with emphasis on hand cases but supplemented by other plastic and reconstructive cases. 4-week elective periods. Washington Hosp. Center.

383 **Endocrine Surgery** (5) Geelhoed
Management of endocrine disorders. Emphasis on control of hyperfunction and neoplasms of the thyroid, parathyroid, adrenal, and pancreatic islet cell glands. Videotaped classic endocrine problems, library and laboratory research, and clinical exposure to surgical endocrinology. 4-week elective periods. Univ. and V.A. Hosp.

384 **Thoracic-Cardiovascular Surgery** (5) Aaron
Basic principles used in thoracic and cardiovascular surgery. 4-week elective periods. Univ. Hosp. and Clinic.

* Required for medical students.

385 **Plastic and Reconstructive Surgery** (5) Thompson
Preoperative and postoperative care, operating room procedures, clinical activities, conferences. Trauma, hand surgery, congenital anomalies, neoplasms in children, head and neck cancer, maxillofacial trauma. 4-week elective periods. Children's Hosp.

386 **Pediatric Surgery** (5) Randolph
Participation in an active, closely supervised surgical service for infants and children, including congenital defects, cardiac surgery, trauma, and neoplasms. 4-week elective periods. Children's Hosp.

388 **Plastic Surgery** (5) Thompson
Participation in an active plastic surgery service, principally aesthetic surgery but also including other types of plastic surgery. Outpatient clinics, operating room procedures, and conferences. 4-week elective periods. Nat'l Naval Med. Center.

389 **Surgical Preceptorship** (5) Thistlethwaite, Isaacson
Care of general surgical patients as seen in private practice. 4-week elective periods.

390 **Extramural Surgery Elective** (arr.)
The department arranges for students to spend one or more elective periods at other institutions. Students must have the approval of the chairman of the department. Tsangaris

391 **Special Programs** (5)
4-week elective periods. Univ. Hosp.

392 **Peripheral Vascular Surgery** (5) Keshishian, Smyth
Study and application of vascular surgery. 4-week elective periods. Walter Reed Hosp. Center. Fouty

393 **Burns** (5)
4-week elective periods. Giordano

394 **Peripheral Vascular Surgery** (5)
4-week elective periods. Univ. Hosp. Geelhoed

395 **Experimental Surgery** (5)
Research projects in surgical research laboratories employing animal models and experimental operative procedures in physiologic investigations. Emphasis on design of experiments, performance of experimental surgical techniques, precision in laboratory data gathering, and analysis of data. Areas of investigations include surgical endocrinology, transplantation and tumor immunology, shock metabolism, and gastrointestinal and cardiovascular physiology. 4-week elective periods. Trout

396 **Peripheral Vascular Surgery** (5)
4-week elective periods. VA. Hosp.

Urology

Chairman: H.C. Miller, Jr.

Professors A.B. Belman, H.C. Miller, Jr.
Clinical Professors F.J. Frensilli, W.D. Jarman, B.T. Mittemeyer, F.T. Reuter
Associate Professors H. Bensimon, S.A. Karmi

Associate Clinical Professors W.L. Banfield, M. Edson, H.A. Goldberg, J.C. Kenealy, A.M. Kwart, C. Rodriguez, H.S. Semerjian
Assistant Professors P.L. Gross, E.J. Kass
Assistant Clinical Professors J.B. Alperstein, M.P. Berger, G. Dudas, W.L. Glover, Jr., F.B. Hendricks, S.O. Kazmi, H.J. Klapproth, J.M. Lebowitz, R.C. Rhame, H. Salcedo, D.T. Schwartz, D.M. Seitzman, I. Shuman, E.H. Soifer, I.J. Spence, R.E. Ware, I.S. Young
Clinical Instructors E.G. Abramson, M.E. Beall, H.E. Bondy, N.L. Constantinople, J.D. Francis, T.E. Kasper, M.I. Murdock, P.I. Shah, S.L. Werner, A.J. Willis

302 **Clinical Clerkship** (3) **Miller, Staff**
2-week elective periods. Univ. Hosp.

380 **Clinical Urology I** (5) **Reuter**
Outpatient and diagnostic urology, cystoscopy, and radiographic procedures. 4-week elective periods. Univ. Hosp.

381 **Clinical Urology II** (5) **Miller and Staff**
Observation of urologic conditions and procedures for diagnosis and treatment; radiologic and pathologic studies, endoscopy and surgery, collateral reading, weekly staff conference. 4-week elective periods. Univ., V.A., and Children's Hosps.

382 **Clinical Urology III** (5) **Hendricks and Staff**
Observation of urologic conditions and procedures for diagnosis and treatment, radiologic and pathologic studies, endoscopy and surgery, collateral reading, weekly staff conference. 4-week elective periods. V.A. Hosp.

390 **Extramural Elective** (arr.)
The department may arrange for selected students to spend one or more elective periods at affiliated institutions: Fairfax, V.A., and Children's Hospitals. Interested students should contact the department chairman.

THE SCHOOL OF MEDICINE AND HEALTH SCIENCES

Faculty and Staff of Instruction*

EMERITI

Theodore Judson Abernethy, *Professor Emeritus of Clinical Medicine*
B.S. 1925, Denison University; M.D. 1929, Johns Hopkins University

Errett Cyril Albritton, *Professor Emeritus of Physiology*
B.A. 1916, University of Missouri; M.D. 1921, Johns Hopkins University

Louis Katz Alpert, *Professor Emeritus of Medicine*
B.S. 1928, M.D. 1932, Yale University

William Staton Anderson, *Professor Emeritus of Clinical Child Health and Development*
B.A. 1927, Duke University; M.D. 1931, Johns Hopkins University

Thomas McPherson Brown, *Professor Emeritus of Medicine*
B.A. 1929, Swarthmore College; M.D. 1933, Johns Hopkins University

Paul Calabrisi, *Professor Emeritus of Anatomy*
B.A. 1931, Catholic University of America; M.A. 1940, George Washington University; Ph.D. 1955, Cambridge University

Jeremiah Keith Cromer, *Professor Emeritus of Clinical Obstetrics and Gynecology*
M.D. 1929, B.A. 1931, George Washington University

Leon Richard Culbertson, *Professor Emeritus of Urology*
B.S., M.D. 1936, University of Virginia

Henry Lauran Darner, *Professor Emeritus of Clinical Obstetrics and Gynecology*
B.A. 1916, Western Maryland College; M.D. 1920, Johns Hopkins University

Samuel Mayer Dodek, *Professor Emeritus of Clinical Obstetrics and Gynecology*
B.A. 1923, George Washington University; M.D. 1927, Thomas Jefferson University; M.A. 1951, Case Western Reserve University

William Rankin Duryee, *Research Professor Emeritus of Pathology (Experimental)*
B.A. 1927, Ph.D. 1933, Yale University

James Albert Dusbabek, *Professor Emeritus of Clinical Obstetrics and Gynecology*
M.D. 1934, George Washington University

Clayton Bernard Ethridge, *Professor Emeritus of Medicine*
M.D. 1933, University of Virginia

* The Faculty and Staff of Instruction listed here and at the head of each department represent appointments current as of July 1981. Faculty and staff members who hold appointments in two or more departments have the department of primary responsibility listed first.

James Joseph Feffer, *Professor Emeritus of Clinical Engineering and of Medicine*
B.A. 1935, Indiana University; M.D. 1938, Indiana University at Indianapolis

Clarence Kendall Fraser, *Professor Emeritus of Clinical Obstetrics and Gynecology*
Ph.B. 1931, College of the Holy Cross; M.D. 1935, Tufts University

James Quincy Gant, Jr., *Professor Emeritus of Clinical Dermatology*
B.A. 1930, M.S. 1931, Ohio State University; M.D. 1935, Medical College of Virginia of Virginia Commonwealth University

Robert Henry Groh, *Professor Emeritus of Clinical Neurology*
B.S. 1935, M.D. 1937, University of Pittsburgh

Clarence Richard Hartman, *Associate Professor Emeritus of Microbiology*
B.A. 1933, M.D. 1936, George Washington University

Roy Hertz, *Research Professor Emeritus of Pharmacology*
B.A. 1930, Ph.D. 1933, M.D. 1939, University of Wisconsin; M.P.H. 1940, Johns Hopkins University

Robert Sexton Higdon, *Professor Emeritus of Dermatology and of Child Health and Development*
B.S. 1933, Millsaps College; M.D. 1937, Tulane University

Vincent Michael Iovine, *Professor Emeritus of Clinical Surgery*
B.S. 1931, Manhattan College; M.D. 1935, Columbia University

Paula Reines Kaiser, *Associate Professor Emeritus of Anesthesiology*
M.B., Ch.B. 1936, University of St. Andrews, Scotland; M.D. 1937, State University of New York

Hayden Kirby-Smith, *Professor Emeritus of Clinical Dermatology*
B.S. 1927, University of the South; M.D. 1937, George Washington University

Calvin Trexler Klopp, *Professor Emeritus of Surgery*
B.A. 1934, Swarthmore College; M.D. 1938, Harvard University

Chester Elwood Leese, *Professor Emeritus of Physiology*
B.A. 1922, M.A. 1925, Ph.D. 1930, University of Iowa

Edward Lewis, *Professor Emeritus of Clinical Pediatrics*
M.D. 1918, George Washington University

Reginald Spencer Lourie, *Professor Emeritus of Child Health and Development and of Psychiatry and Behavioral Sciences*
B.S. 1930, Cornell University; M.D. 1936, State University of New York Downstate Medical Center; Med.Sc.D. 1941, Columbia University

Benjamin Manchester, *Professor Emeritus of Clinical Medicine*
M.D. 1935, George Washington University

Joseph Francis Ney, *Professor Emeritus of Clinical Medicine*
B.S. 1931, University of Virginia; M.D. 1935, Harvard University

Margaret Mary Nicholson, *Professor Emeritus of Clinical Pediatrics*
B.A. 1922, M.D. 1925, George Washington University

George Nordlinger, *Professor Emeritus of Clinical Obstetrics and Gynecology*
B.A. 1918, M.D. 1922, George Washington University

Thomas Martin Peery, *Professor Emeritus of Pathology*
B.A. 1928, D.M.S. 1966, Newberry College; M.D. 1932, Medical University of South Carolina

Leonard Theodore Peterson, *Professor Emeritus of Clinical Orthopaedic Surgery*
B.A., B.S. 1928, M.D. 1931, University of Minnesota

Herbert Pollack, *Professor Emeritus of Clinical Medicine (Biochemistry)*
B.A. 1925, Washington and Lee University; M.D. 1929, Cornell University; Ph.D. 1933, University of Minnesota

Andrew Gabriel Prandoni, *Professor Emeritus of Clinical Medicine*
B.S. 1934, Fordham University; M.D. 1938, State University of New York Downstate Medical Center

Lawrence Elias Putnam, *Professor Emeritus of Clinical Medicine*
B.A. 1930, M.D. 1934, Harvard University

Mary Louise Robbins, *Professor Emeritus of Microbiology*
B.A. 1934, American University; M.A. 1940, Ph.D. 1944, George Washington University

Benjamin Rones, *Professor Emeritus of Clinical Ophthalmology*
B.A. 1922, M.D. 1926, Johns Hopkins University

Ernest Alfred Watson Sheppard, *Professor Emeritus of Clinical Ophthalmology*
M.D., C.M. 1926, Queens University, Canada

Harold Stevens, *Professor Emeritus of Neurology*
B.S. 1933, Pennsylvania State University; M.A. 1934, Ph.D. 1937, M.D. 1941, University of Pennsylvania

Donald Harrison Stubbs, *Professor Emeritus of Clinical Anesthesiology*
B.A. 1929, M.A. 1931, M.D. 1932, George Washington University

Ira Rockwood Telford, *Professor Emeritus of Anatomy*
B.A. 1931, M.A. 1933, University of Utah; Ph.D. 1942, George Washington University

Thomas Carlton Thompson, *Professor Emeritus of Clinical Urology*
B.S. in Med., M.D. 1920, George Washington University

Janet Graeme Travell, *Professor Emeritus of Clinical Medicine*
B.A. 1922, Wellesley College; M.D. 1926, Cornell University

Carleton Raymond Treadwell, *Professor Emeritus of Biochemistry*
B.A. 1934, Battle Creek College; M.S. 1935, Ph.D. 1939, University of Michigan

John Augustine Washington, *Professor Emeritus of Clinical Child Health and Development*
B.A. 1924, Virginia Military Institute; B.S. 1926, University of Virginia; M.D. 1930, Johns Hopkins University

James Winston Watts, *Professor Emeritus of Neurological Surgery*
B.S. 1924, Virginia Military Institute; M.D. 1928, University of Virginia

Richard Wallace Wilkinson, *Professor Emeritus of Clinical Ophthalmology*
B.A. 1925, M.D. 1928, George Washington University; M.S. in Med. 1932, University of Pennsylvania

Jonathan Marshall Williams, *Professor Emeritus of Clinical Neurological Surgery*
B.S. in Med. 1936, Loyola University of Chicago; M.D. 1938, University of Chicago

ACTIVE

Benjamin Larry Aaron, *Associate Professor of Surgery*
B.A. 1954, University of Missouri; M.D. 1958, University of Texas Medical Branch at Galveston

Charles Owen Abernathy, *Special Lecturer in Physiology*
A.B. 1964, Asbury College; M.S. 1966, University of Kentucky; Ph.D. 1970, North Carolina State University

Andreas Andrew Abraham, *Associate Professor of Pathology*
M.D. 1953, University of Szeged, Hungary

Kristof Abraham, *Associate Clinical Professor of Neurology*
M.D. 1952, University of Budapest

Palma Feheruari Abraham, *Associate Clinical Professor of Radiology*
M.D. 1954, University of Budapest

Michael David Abramowitz, *Assistant Professor of Anesthesiology and of Child Health and Development*
M.B., B.Ch. 1972, University of Witwatersrand, South Africa

Charles Barrett Abrams, *Assistant Clinical Professor of Medicine*
B.S. 1967, Bethany College; M.D. 1971, West Virginia University

Edward Gerald Abramson, *Clinical Instructor in Urology*
B.A. 1962, University of Pennsylvania; M.D. 1967, University of Virginia

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B.A. 1962, Case Western Reserve University; Ph.D. 1965, Ohio State University

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B.S. 1943, University of Missouri, M.D. 1945, Washington University

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B.S. 1943, M.D. 1947, Tufts University

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B.S. 1955, Punjab University, India; M.B., B.S. 1960, Osmani University, India; D.P.M. 1964, Mysore University, India

Lewis Francis Affronti, *Professor of Microbiology; Chairman of the Department of Microbiology*
B.A. 1950, M.A. 1951, State University of New York at Buffalo; Ph.D. 1958, Duke University

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B.A. 1967, University of Rochester; M.D. 1972, Tulane University

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M.B., B.S. 1966, University of London, M.R.C.S., L.R.C.P. 1966, Royal College of Physicians and Surgeons

Julio Estuardo Alarcon, *Clinical Instructor in Obstetrics and Gynecology*
M.D. 1966, University of Trujillo, Peru

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B.A. 1949, M.D. 1953, American University of Beirut

Dan George Albert, *Assistant Clinical Professor of Ophthalmology and of Child Health and Development*
B.S. 1938, Ohio State University, M.D. 1950, State University of New York Upstate Medical Center

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Julia W. Albright, *Associate Research Professor of Microbiology*
B.S. 1962, East Tennessee State University, M.S. 1972, University of Akron; Ph.D. 1978, Indiana State University

Yousef Al-Doory, *Associate Professor of Pathology (Laboratory Medicine)*
B.S. 1945, University of Baghdad, M.A. 1951, University of Texas; Ph.D. 1954, Louisiana State University

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B.S. 1958, City University of New York, Queens College; M.S. 1960, University of Connecticut; M.D. 1964, Yeshiva University

Elliot Aleskow, *Clinical Instructor in Medicine*
B.S. 1973, M.D. 1977, University of Maryland

Theodore Crandall Alford, *Associate Professor of Surgery*
B.A. 1944, Haverford College; M.D. 1947, Johns Hopkins University

Frank Duane Allan, *Professor of Anatomy; Director of Audiovisual Education, Medical Center*
B.S. 1947, M.S. 1949, University of Utah; Ph.D. 1954, Louisiana State University

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B.A. 1952, City University of New York, Brooklyn College; M.A. 1953, City University of New York, City College; Ph.D. 1958, University of Denver

Robert Mayer Allman, *Clinical Professor of Radiology*
B.S. 1953, Dickinson College; M.D. 1957, Thomas Jefferson University

Melvin Gustavus Alper, *Clinical Professor of Ophthalmology and of Neurological Surgery*
B.A. 1943, M.D. 1945, University of Virginia

Joel Barry Alperstein, *Assistant Clinical Professor of Urology*
B.S. 1961, M.D. 1967, University of Maryland

Hubert Joseph Alpert, *Clinical Instructor in Medicine*
M.D. 1962, University of Illinois

Seymour Alpert, *Professor of Anesthesiology; Vice President for Development*
B.A. 1939, Columbia University; M.D. 1943, State University of New York Downstate Medical Center

Elliott Joel Alpher, *Assistant Clinical Professor of Surgery (Oral Surgery)*
B.S. 1961, University of Maryland; D.D.S. 1965, Georgetown University

Michael Francis Altieri, *Instructor in Child Health and Development*
B.A. 1973, Colgate University; M.D. 1977, George Washington University

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B.A. 1949, Bryn Mawr College; M.A. 1952, M.D. 1956, Vanderbilt University

Antonina Neri Amigable, *Assistant Professor of Medicine*
M.D. 1966, Cebu Institute of Technology, Philippines

Sirus Amiri, *Assistant Clinical Professor of Child Health and Development*
M.D. 1956, University of Tehran

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B.A. 1969, Case Western Reserve University; M.D. 1972, George Washington University

Harvey Hirsch Ammerman, *Clinical Professor of Neurological Surgery*
B.S. 1939, M.D. 1943, George Washington University

Richard Gene Ammerman, *Assistant Clinical Professor of Psychiatry and Behavioral Sciences*
B.A. 1964, Yale University; M.D. 1968, Tufts University

Theodore H. Anders, *Associate Clinical Professor of Child Health and Development*
B.A. 1952, M.D. 1956, University of Rochester

Andrew Stephen Anderson, *Assistant Professor of Anesthesiology*
A.B. 1966, King College; M.Phil. 1969, Ph.D. 1971, Yale University; M.D. 1976, University of Tennessee

Daniel Stonewall Anderson, *Assistant Clinical Professor of Health Care Sciences*
M.A. 1964, University of Oklahoma; M.D., M.S. 1972, University of Arkansas

Elizabeth Potts Anderson, *Professorial Lecturer in Biochemistry*
B.A. 1945, Sarah Lawrence College; M.S. 1947, University of Wisconsin; Ph.D. 1950, Stanford University

Frank Hughes Anderson, *Assistant Clinical Professor of Neurology*
B.A. 1966, M.D. 1970, Harvard University

James Edward Anderson, *Assistant Clinical Professor of Obstetrics and Gynecology*
B.A. 1955, Union College, Nebraska; M.D. 1965, Loma Linda University

Kathryn Duncan Anderson, *Associate Professor of Surgery and of Child Health and Development*
B.A. 1961, M.A. 1964, Cambridge University; M.D. 1964, Harvard University

Rebecca Jane Anderson, *Associate Professor of Pharmacology*
B.A. 1971, Coe College; Ph.D. 1975, Georgetown University

John Lawrence Angel, *Professorial Lecturer in Anatomy and in Anthropology*
B.A. 1936, Ph.D. 1942, Harvard University

William Leighton Anixter, *Clinical Instructor in Psychiatry and Behavioral Sciences*
M.D. 1977, George Washington University

Tatiana Antonovych, *Professorial Lecturer in Pathology*
M.D. 1941, University of Vienna

James Richard Appleton, *Assistant Clinical Professor of Surgery (Plastic Surgery)*
B.A. 1957, University of Iowa; M.D. 1961, University of Maryland

Osbert Mark Applewhaite, *Clinical Instructor in Medicine*
B.S. 1971, Howard University; M.D. 1976, University of Pennsylvania

Aram Albert Arabian, *Assistant Professor of Medicine*
A.B. 1965, Boston University; M.D. 1975, Brown University

Marta Ewa Archutowska-Kempka, *Adjunct Instructor in Neurology*
M.D. 1971, Higher School of Medicine, Poland

Irwin Ardam, *Assistant Clinical Professor of Medicine*
B.A. 1948, New York University; M.D. 1954, New York Medical College

Joseph Ardizzone, *Assistant Professor of Medicine*
B.S. 1949, Medical College of Virginia of Virginia Commonwealth University

Bryan Arling, *Associate Clinical Professor of Medicine*
B.A. 1965, University of Minnesota; M.D. 1969, Harvard University

Mansour Farid Armaly, *Professor of Ophthalmology; Chairman of the Department of Ophthalmology*
B.A. 1947, M.D. 1952, American University of Beirut; M.S. 1957, University of Iowa

Vernon W. Armbrustmacher, *Professorial Lecturer in Neurological Surgery*
M.D. 1964, University of Michigan

John Andrew Armer, *Clinical Instructor in Neurology*
B.A. 1956, Reed College; M.D. 1962, University of Rochester

Bernard Sol Arons, *Assistant Clinical Professor of Psychiatry and Behavioral Sciences*
B.A. 1969, Oberlin College; M.D. 1973, Case Western Reserve University

Philip Assatourians, *Assistant Clinical Professor of Medicine*
M.D. 1964, University of Tehran

Emmanuel Atiemo, *Assistant Clinical Professor of Obstetrics and Gynecology*
M.B., B.S. 1970, Ghana Medical School

Francis Bernard Atkins, *Adjunct Assistant Professor of Radiology*
B.S. 1968, Pratt Institute; M.S. 1971, Rutgers—The State University; Ph.D. 1978, University of Chicago

Gilbert Paul August, *Associate Professor of Child Health and Development*
B.S. 1958, City University of New York, City College; M.D. 1962, New York University

Gunter Josef Augustin, *Clinical Professor of Radiology*
M.D. 1952, University of Heidelberg

Gordon Avery, *Professor of Child Health and Development*
B.A. 1953, Harvard University; M.D. 1958, Ph.D. 1959, University of Pennsylvania

Benjamin Avrunin, *Assistant Clinical Professor of Health Care Sciences*
B.S. 1963, Georgetown University; M.D. 1978, Tulane University

Julius Axelrod, *Professorial Lecturer in Pharmacology*
B.S. 1933, City University of New York, City College; M.A. 1941, New York University; Ph.D. 1955, LL.D. 1971, George Washington University; Sc.D. 1966, University of Chicago

Silas Babin, *Assistant Clinical Professor of Medicine*
M.D. 1951, Louisiana State University, New Orleans

Beverly T. Backus, *Assistant Research Professor of Microbiology*
B.A. 1962, University of California, Berkeley; M.S. 1967, Ph.D. 1976, George Washington University

James Michael Bacos, *Professor of Medicine*
B.S. 1948, Virginia Polytechnic Institute and State University; M.D. 1953, Duke University

Robert Emil Badwey, *Assistant Clinical Professor of Obstetrics and Gynecology*
B.S. 1955, Franklin and Marshall College; M.D. 1959, University of Pittsburgh

Alfred Baer, *Clinical Professor of Medicine*
B.A. 1942, Ohio State University; M.D. 1945, Johns Hopkins University

Duane Charles Bailey, *Adjunct Instructor in Health Care Sciences*
B.S. 1976, Alderson-Broaddus College

John Martyn Bailey, *Professor of Biochemistry*
B.S. 1949, Ph.D. 1952, D.Sc. 1970, University of Wales

William Otis Bailey, Jr., *Associate Clinical Professor of Medicine*
M.D. 1940, George Washington University

William Prentice Baker, *Professor of Medicine*
B.S. 1949, Indiana University; M.S. 1953, Ph.D. 1955, Michigan State University; M.D. 1958, University of Michigan

Guillermo Alfredo Balfour, *Associate Clinical Professor of Child Health and Development*
M.D. 1959, University of Buenos Aires

Eugene Joseph Banasiak, *Adjunct Assistant Professor of Radiology*
B.S. 1971, Rutgers—The State University

Bernard Alvin Band, *Assistant Clinical Professor of Obstetrics and Gynecology*
B.A. 1952, B.S. 1954, George Washington University; M.D. 1959, Howard University

William Landon Banfield III, *Associate Clinical Professor of Urology*
B.A. 1954, Princeton University; M.D. 1958, George Washington University

Herbert Stuart Block Baraf, *Assistant Clinical Professor of Medicine*
B.S. 1969, University of Michigan; M.D. 1973, State University of New York Downstate Medical Center

Joan Barber, *Associate Professor of Psychiatry and Behavioral Sciences*
B.A. 1946, Wellesley College; M.D. 1949, Cornell University

Lewellys Franklin Barker, *Associate Clinical Professor of Medicine*
B.A. 1955, Princeton University; M.D. 1959, Johns Hopkins University

Ann Birnbaum Barnet, *Associate Professor of Neurology and of Child Health and Development*
B.A. 1951, Sarah Lawrence College; M.D. 1956, Harvard University

Ida Sue Baron-Starke, *Assistant Professor of Neurological Surgery and of Child Health and Development*
B.S. 1968, Cornell University; M.A. 1972, Ph.D. 1976, University of Maryland

Walter Erik Barquist, *Assistant Clinical Professor of Psychiatry and Behavioral Sciences*
B.A. 1964, George Washington University; M.D. 1969, New York University

Norman Lee Barr, Jr., *Clinical Professor of Otolaryngology*
B.A. 1959, Princeton University; M.D. 1965, Georgetown University

S. Otesia Barr, *Clinical Instructor in Child Health and Development*
B.A. 1970, Mount Holyoke College; M.S. 1973, Howard University; M.D. 1977, University of Pennsylvania

Solomon Efrem Barr, *Associate Clinical Professor of Medicine*
B.A. 1951, M.D. 1954, George Washington University

John William Barrett, *Assistant Clinical Professor of Neurological Surgery*
M.D. 1958, George Washington University

Robert Henry Barter, *Professor of Obstetrics and Gynecology*
B.S. 1937, M.D. 1940, University of Wisconsin

Robert Lewis Barth, *Adjunct Assistant Professor of Anesthesiology*
B.A. 1966, Yale University; M.D. 1970, University of Pennsylvania

Werner Franklin Barth, *Professor of Medicine*
B.A. 1956, Columbia University; M.D. 1960, Yeshiva University

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A.B. 1968, College of the Holy Cross; M.D. 1972, Northwestern University

Ronald Stephen Bashian, *Assistant Clinical Professor of Child Health and Development*
B.A. 1968, Amherst College; M.D. 1972, State University of New York Downstate Medical Center

Constance Urciolo Battle, *Professor of Child Health and Development*
B.A. 1963, Trinity College, District of Columbia; M.D. 1967, George Washington University

John Henry Bayly, *Special Lecturer in Surgery and in Child Health and Development*
B.S. 1936, Rensselaer Polytechnic Institute; M.D. 1940, Georgetown University

Michael Edgar Beall, *Clinical Instructor in Urology*
B.A. 1968, Ohio Wesleyan University; M.D. 1972, George Washington University

Barbara Louise Bean, *Assistant Professor of Pharmacology*
B.S. 1970, University of Surrey; Ph.D. 1976, University of London

Lillian McLean Beard, *Assistant Clinical Professor of Child Health and Development*
B.S. 1965, M.D. 1970, Howard University

Harry Carl Beaver, *Assistant Clinical Professor of Obstetrics and Gynecology*
B.S. 1959, Wheaton College; M.D. 1963, George Washington University

Arthur Abbe Becker, *Associate Clinical Professor of Obstetrics and Gynecology*
B.S. 1956, City University of New York, City College; M.D. 1961, University of Iowa

Joan Alaine Becker, *Assistant Professor of Radiology (Allied Health)*
B.S. 1976, Ohio State University

Kenneth Louis Becker, *Professor of Medicine*
B.A. 1952, University of Michigan; M.D. 1956, New York Medical College; Ph.D. 1963, University of Minnesota

Matthew Joseph Becker, *Assistant Professor of Anesthesiology and of Child Health and Development*
B.S. 1971, Massachusetts Institute of Technology; M.D. 1974, Duke University

Harry James Beecham III, *Adjunct Assistant Professor of Health Care Sciences*
A.B. 1970, Asbury College; M.D. 1974, Medical College of Georgia

Edward Arthur Beeman, *Assistant Clinical Professor of Medicine*
B.A. 1943, Harvard University; M.D. 1947, Boston University; M.S. 1956, University of Minnesota

Malcom Sydney Beinfield, *Associate Clinical Professor of Health Care Sciences*
B.A. 1942, Yale University; M.D. 1945, State University of New York Downstate Medical Center

Gustavo Sastrano Belaval, *Associate Clinical Professor of Medicine*
M.D. 1942, George Washington University

Samuel Michael Belinsky, *Clinical Professor of Obstetrics and Gynecology*
B.A. 1955, University of Bridgeport; M.D. 1959, George Washington University

A. Barry Belman, *Professor of Urology and of Child Health and Development*
B.A. 1960, University of Arizona; M.D. 1964, M.S. 1969, Northwestern University

Carol Laura Bender, *Clinical Instructor in Medicine*
B.S. 1965, Cornell University; M.A. 1966, Columbia University; M.D. 1972, State University of New York Upstate Medical Center

Ruth Boschwitz Benedict, *Associate Clinical Professor of Medicine*
B.A. 1935, Wellesley College; M.D. 1939, New York University

Howard Jay Bennett, *Assistant Professor of Health Care Sciences and of Child Health and Development*
B.S. 1972, University of Maryland; M.D. 1977, George Washington University

Linda Anne Marshall Bennett, *Assistant Research Professor of Psychiatry and Behavioral Sciences*
B.A. 1965, Clarion State College; M.A. 1966, Indiana University; Ph.D. 1976, American University

Hector Bensimon, *Associate Professor of Urology*
M.D. 1946, Buenos Aires Medical School

Luis Felipe Bentolila, *Assistant Clinical Professor of Medicine*
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School of Engineering and Applied Science, Admissions Office, School of Engineering and Applied Science

National Law Center, Admissions Office, National Law Center

School of Medicine and Health Sciences, Admissions Office, School of Medicine and Health Sciences

Schedule of Classes—On Campus, Fall and Spring Semesters, Registrar

Schedule of Classes—Off Campus, Fall, Spring, and Summer, Division of Continuing Education and Summer Sessions

Schedule of Classes, Summer Sessions, Office of University and Summer Students

COLLEGES AND SCHOOLS—DEGREE PROGRAMS

COLUMBIAN COLLEGE OF ARTS AND SCIENCES: Associate in Arts (A.A), Associate in Arts in General Studies (A.A. in Gen.Std.), Associate in Science in Cartographic Science (A.S. in Cart.Sc.), Associate in Science in Geodesy (A.S. in Geod.), Bachelor of Arts (B.A.), Bachelor of General Studies (B.Gen.Std.), Bachelor of Music (B.Mus.), Bachelor of Science (B.S.), Bachelor of Science in Cartographic Science (B.S. in Cart.Sc.), and Bachelor of Science in Geodesy (B.S. in Geod.)

GRADUATE SCHOOL OF ARTS AND SCIENCES: Master of Arts (M.A.), Master of Arts in Special Studies (M.A. in Sp.Std.), Master of Fine Arts (M.F.A.), Master of Forensic Sciences (M.F.S.), Master of Music (Mus.M.), Master of Science (M.S.), Master of Science for Teachers (M.S. for Teachers), Master of Science in Forensic Science (M.S.F.S), Master of Science in Special Studies (M.S. in Sp.Std.), and Doctor of Philosophy (Ph.D.)

SCHOOL OF MEDICINE AND HEALTH SCIENCES: Associate in Science (A.S.), Bachelor of Science (B.S.), Bachelor of Science in Health Science (B.S. in H.Sc.), and Doctor of Medicine (M.D.)

NATIONAL LAW CENTER: Juris Doctor (J.D.), Master of Laws (LL.M.), Master of Comparative Law (M.Comp.L.), Master of Comparative Law (American Practice) (M.Comp.L. [Am.Prac.]), and Doctor of Juridical Science (S.J.D.)

SCHOOL OF ENGINEERING AND APPLIED SCIENCE: Bachelor of Science (Civil Engineering) (B.S. [C.E.]), Bachelor of Science (Electrical Engineering) (B.S. [E.E.]), Bachelor of Science (Mechanical Engineering) (B.S. [M.E.]), Bachelor of Science (Operations Research and Computational Science) (B.S. [O.R.&C.S.]), Master of Engineering Administration (M.E.A.), Master of Science (M.S.), Engineer (Engr.), Applied Scientist (App.Sc.), and Doctor of Science (D.Sc.)

SCHOOL OF EDUCATION AND HUMAN DEVELOPMENT: Bachelor of Arts in Education and Human Development (B.A. in Ed.&H.D.), Bachelor of Science in Human Kinetics and Leisure Studies (B.S. in H.K.L.S.), Master of Arts in Education and Human Development (M.A. in Ed.&H.D.), Master of Arts in Teaching (M.A.T.), Education Specialist (Ed.S.), and Doctor of Education (Ed.D.)

SCHOOL OF GOVERNMENT AND BUSINESS ADMINISTRATION: Bachelor of Business Administration (B.B.A.), Master of Accounting (M.Acct.), Master of Business Administration (M.B.A.), Master of Health Services Administration (M.H.S.A.), Master of Public Administration (M.P.A.), Master of Science in Information Systems Technology (M.S. in I.S.T.), Master of Urban and Regional Planning (M.U.&R.P.), Post-Master's Graduate Certificate in Health Services Administration (Grad.Cert. in H.S.A.), Doctor of Business Administration (D.B.A.), and Doctor of Public Administration (D.P.A.)

SCHOOL OF PUBLIC AND INTERNATIONAL AFFAIRS: Bachelor of Arts (B.A.) and Master of Arts (M.A.)



THE
GEORGE
WASHINGTON
UNIVERSITY

NATIONAL LAW CENTER BULLETIN

1982-1983





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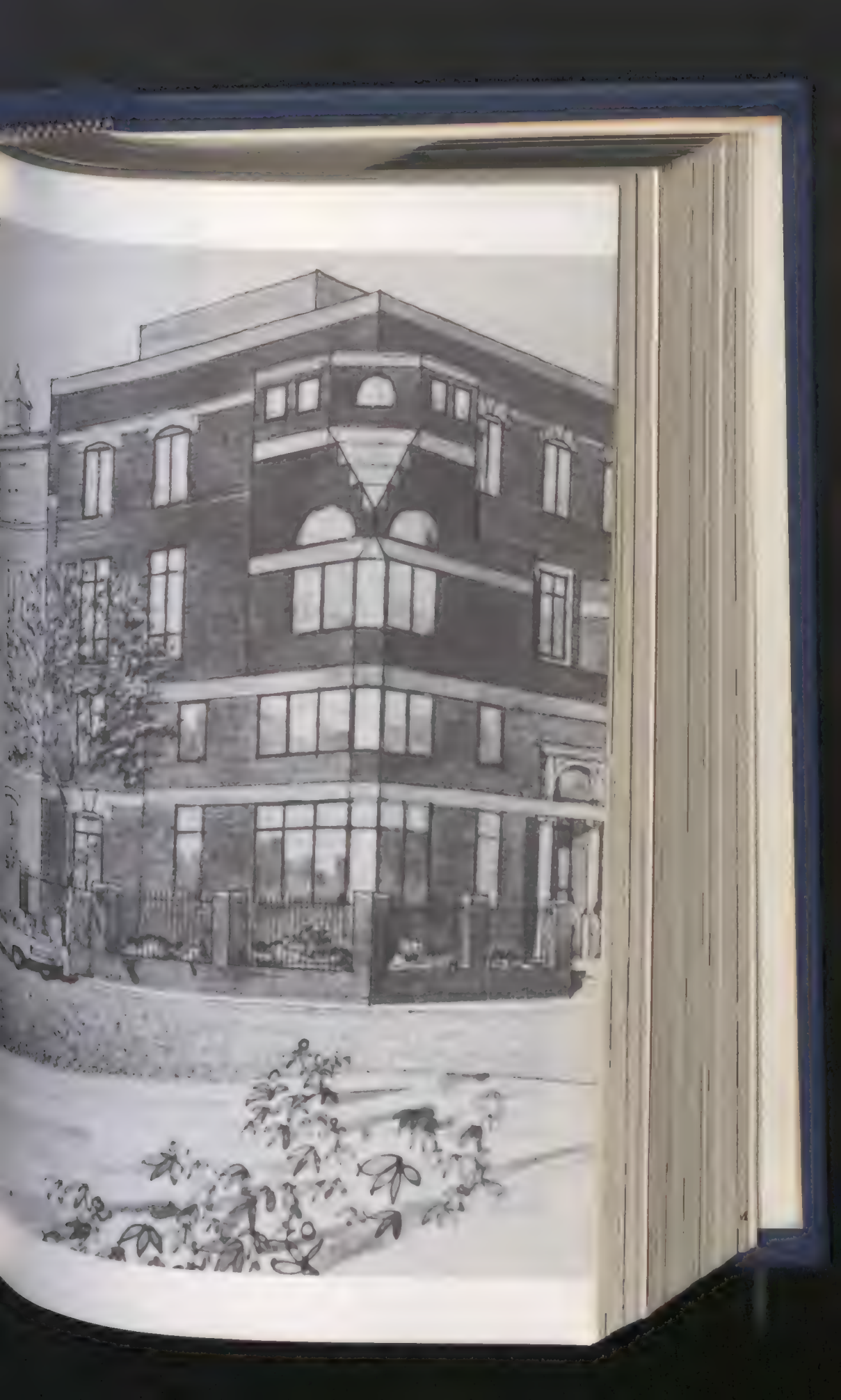
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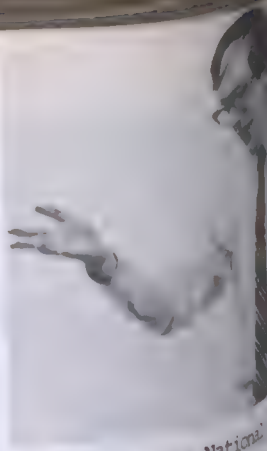
NATIONAL LAW CENTER BULLETIN
1982–1983

WASHINGTON, D.C. 20052



Architectural drawing of the extended National Law Center.





TO PROSPECTIVE STUDENTS.

This Bulletin of the George Washington University National Law Center contains general information about such matters as admission, registration, fees, and financial aid, as well as a listing of our faculty and courses of instruction. We are one of the nation's large law schools. But, nonetheless, there always has been a tradition of friendliness among our students and an attitude of accessibility on the part of our faculty. If you join us as first-year students, you will discover that the first-year life of the school is an intense one. Each of the sections into which the first-year class is divided becomes a little community of its own with a camaraderie and esprit de corps which will make that first year one of the most vivid of your lives.

The National Law Center is an institution that is characterized by the richness and diversity of its programs. Whether you are joining us as a J.D. student or an LL.M. student, your time here will be one of intellectual growth. In your upper-class years, you may choose to take one of the many courses and programs in fields such as Constitutional Rights, Administrative Law, Environmental and Energy Law, Government Contracts, International Law, Labor Law and Antitrust Law, Land Development Law, Patent Law, or Taxation, which have given this school its reputation as a center for study and research in public law. If you come to us as a graduate student you may choose to specialize in one of the areas just mentioned. As J.D. students in your upper-class years, you might also choose to direct your energies to one of the School's varied and intense programs in Clinical Law. The class entering The National Law Center in the fall of 1982 should find its years here particularly memorable. A $16.7 million expansion program of the physical facilities of The National Law Center is planned. The program encompasses a major renovation of Stockton Hall and the Jacob Burns Law Library, tying them to an impressive new classroom building replacing Bacon Hall to the north and a handsome addition to the Law Library to the south.

As is evident, The National Law Center is a large and dynamic place, but we believe it is a community. We hope that you will aspire to join us and become a part of that community.

Jerome A. Barron
Dean

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1982 SUMMER TERM

May 24	Registration for all sessions *Monday* (noon-6:30 p.m.)
	Application for September graduation due as part of registration
	First-session and 13-week session classes begin
July 2	First-session classes end *Friday*
July 5	Holiday *Monday*
July 6, 7, 8	First-session examination period *Tuesday-Thursday*
July 9	Registration *Friday* (9:30 a.m.-2 p.m. and 4-6 p.m.)
	Application for September graduation due as part of registration
	Second-session classes begin
August 17	Last day of classes *Tuesday*
August 18, 19, 20	Second-session and 13-week session examination period *Wednesday-Friday*

*The Academic Calendar is subject to change.

1982 FALL SEMESTER

August 19, 20	Registration *Thursday* (12:30-7 p.m.) and *Friday* (3-7 p.m.) Application for February graduation due as part of registration
August 23	Classes begin *Monday*
September 6	Labor Day (holiday) *Monday*
October 8	S.J.D. dissertations of February candidates due *Friday*
November 24	Thanksgiving recess begins after last class *Wednesday*
November 29	Classes resume *Monday*
December 3	Last day of fall-semester classes *Friday* LL.M. theses of February candidates due
December 6–17	Reading and examination period

1983 SPRING SEMESTER

January 6–7	Registration *Thursday* (12:30-7 p.m.) and *Friday* (3-7 p.m.) Application for May graduation due as part of registration
January 10	Classes begin *Monday*
January 28	S.J.D. dissertations of May candidates due *Friday*
February 21	Winter Convocation (holiday) *Monday*
March 2	Completed applications for 1983-1984 teaching fellowships due *Wednesday*
March 19	Spring recess begins after last class *Saturday*
March 28	Classes resume *Monday*
April 29	LL.M. theses of May candidates due *Friday*
April 30	Last day of spring-semester classes *Saturday*
May 1–13	Reading and examination period
May 22	Commencement *Sunday*

GEORGE WASHINGTON
UNIVERSITY

THE NATIONAL LAW CENTER

HISTORY

E LAW CENTER, the oldest law school in the District of Columbia, was es-blished in 1865 with a formal program of two years of study. This was gely through the efforts of the Reverend George Whitefield Samson, Presi-nt of Columbian College, whose action resulted in the purchase of a separate ilding for holding law classes. The building had belonged to Trinity Church, which Francis Scott Key had been Senior Warden. It was occupied by the w Center until 1884.

Sixty graduates, from 22 of the then 37 states, received degrees in 1867. e school continued to have a student body and a faculty which reflected fact that it was at the seat of our nation's government. Associate Justices vid J. Brewer and John Marshall Harlan of the Supreme Court of the ited States were among the prominent members of the bench and bar who e on the faculty.

n 1877, one year after the first such program was adopted in the United tes, the Law Center instituted a course leading to the degree of Master of w. In 1898, the course of instruction for the degree of Bachelor of Laws extended to three years. The Law Center took part in 1900 in the organi-on of the Association of American Law Schools.

n the past quarter-century the Law Center expanded its course and seminar rings with consideration of the needs of first-degree and graduate students. degree of Doctor of Juridical Science was instituted in 1940. The need foreign lawyers who came to this country and who required additional paration for law work in the United States resulted in the creation of pro-m for the degrees of Master of Comparative Law in 1946 and Master of mparative Law (American Practice) in 1951.

n 1954, National University School of Law, which had an important place egal education in the District of Columbia since 1869, was absorbed by the rge Washington University Law School.

nce 1954, programs of special research and study have enriched the basic rriculum. At present these include Taxation; Labor Law; Environmental Energy Law; Patent Law; International and Comparative Law; and Gov-ent Contracts. The academic courses reflect the breadth in public law for h the Law Center is well known.

dditionally, the Law Center has been a leader in developing a curriculum eet the legal needs of the poor and the disadvantaged. A clinical law ram has been developed which is the equal of that at any law school in tion. Special projects include the Consumer Protection Center, the munity Legal Clinic, Clinical Studies in Environmental Law, Students in t, and individual projects supervised by the Law Students Civil Rights arch Council.

alizing the need for legal services for all members of society, the Na-l Law Center, while maintaining its strong course offerings in patent law, inistrative law, taxation and government contracts, has developed a rich ion of courses, traditional and clinical, oriented toward the needs of the the elderly, and the consumer.

UNIVERSITY POLICY ON EQUAL OPPORTUNITY

George Washington University does not discriminate against any person on the basis of race, color, religion, sex, national origin, age, handicap, or veteran status. This policy covers all programs, services, policies, and procedures of the University, including admission to educational programs and employment. The University is also subject to the District of Columbia Human Rights Law.

Inquiries concerning the application of this policy and federal laws and regulations concerning discrimination in education or employment programs and activities may be addressed to Dr. Marianne Phelps, Assistant Provost for Affirmative Action, George Washington University, Rice Hall, Washington, D.C. 20052, or to the Assistant Secretary for Civil Rights of the Department of Education.

LOCATION IN THE NATION'S CAPITAL

Of special significance is the location of the National Law Center in the nation's capital, the focal point of the law in action, both American and international. The work of the Center goes on in this environment, presenting a unique opportunity for observation and study of federal agencies—judicial, legislative, and administrative. Readily accessible are the Supreme Court of the United States, the federal trial and appellate courts of the District of Columbia, and, in addition, federal courts of special jurisdiction, such as the United States Court of Claims, the United States Court of Customs and Patent Appeals, the United States Tax Court, and the Court of Military Appeals. Current federal legislation can be studied as it is considered by Congressional committees and as it comes up for debate on the floors of the House of Representatives and the Senate. With respect to the federal administrative agencies, students here in Washington have matchless opportunities for study and observation. They can attend informal and formal hearings of these agencies and can obtain from the docket sections complete records of administrative adjudication in specific cases. Illustrative of such federal agencies are the Interstate Commerce Commission and the Civil Aeronautics Board in the field of transportation; the Federal Trade Commission in the field of trade regulation; the Securities and Exchange Commission in the field of security issues and corporate finance; the National Labor Relations Board in the field of labor-management relations; the United States Patent Office in the field of patent law; the Federal Power Commission in the field of water, natural gas, and electric power; and the Federal Communications Commission in the field of radio and television.

Supplementing these environmental advantages of law in action are the exceptional research library collections in the Library of Congress, in the various departments of the federal government, and in the libraries of the headquarters of national and international organizations. The notable library of the Carnegie Foundation for International Peace has been acquired by George Washington University for use of research students in international and comparative law, fields with respect to which Washington has come to be called "The Capital of the World."

The years of residence at law school are years of participation in the life of the community, which in the case of the George Washington University National Law Center is the government of the United States. As a consequence, the study of law takes on added meaning, whether the goal be governmen-

service or practice, general or specialized, and whatever the community in which the student plans to practice.

ENRICHMENT PROGRAM

The Law Center supplements and enriches its diverse law programs by bringing to the school eminent legal scholars, judges, distinguished members of the bar, members of Congress, and high-level government officials to offer lectures and informal seminars with students and faculty. Last year participants in the enrichment program included: Treasury Secretary Donald Regan; U.S. Court of Appeals Judges J. Clifford Wallace and Patricia Wald; *New York Times* columnist Anthony Lewis; Professor Alan Dershowitz, civil liberties advocate and criminal law specialist; Dean Derrick Bell, litigator and scholar in the field of civil rights; Irving Younger, private practitioner and former judge and law teacher; and Professor David Ratner, corporate and securities law specialist. The enrichment program, funded largely by gifts from alumni and friends of the Law Center, includes several endowed lectureships and a visiting scholar program.

OBJECTIVES

The purpose of the National Law Center is to prepare men and women to meet the needs of society in many fields of law and to encourage scholarly research and writing in the law. As a national law school, the Center does not emphasize any particular geographic area in its instruction; therefore, it prepares students to practice law in any part of the country. The Center also offers a program of legal education for foreign students. The Law Center seeks to fulfill these objectives through (1) a rich and varied curriculum taught by eminent professors and highly qualified specialized instructors; (2) an extensive clinical law program in which students learn legal skills by actual practice; (3) two law journals which specialize in public law and international law; (4) trial practice; (5) participation in the Van Vleck Appellate Case Club, and several other moot court competitions; (6) a series of student professional co-curricular activities; (7) studies on an advanced level for foreign as well as for American students; (8) a continuing legal education program for members of the bar providing them with opportunities for course work within the curriculum; and (9) scholarly research and writing in the law.

THE NATIONAL LAW CENTER COMPLEX

The National Law Center Complex consists of three buildings: Stockton Hall, Bacon Hall, and the Jacob Burns Law Library.

Stockton Hall

Stockton Hall is the main classroom building. It also holds faculty offices and the offices of the Dean and the Associate Deans of the Law Center, as well as the Records Office and student lounges.

Bacon Hall

Bacon Hall houses faculty offices; student lounges; the *George Washington Law Review* Office; the Government Contracts Program; the Admissions Of-

fice; the Law Center Placement Office; the offices of the *Journal of International Law and Economics;* the Black American Law Student Association; the Law Students Civil Rights Research Council; the Van Vleck Appellate Case Club; the *Advocate*, the law school newspaper; the Student Bar Association; the Consumer Protection Center; the Community Legal Clinic; and Movimiento Legal Latino, the national Latino law students association.

The Jacob Burns Law Library

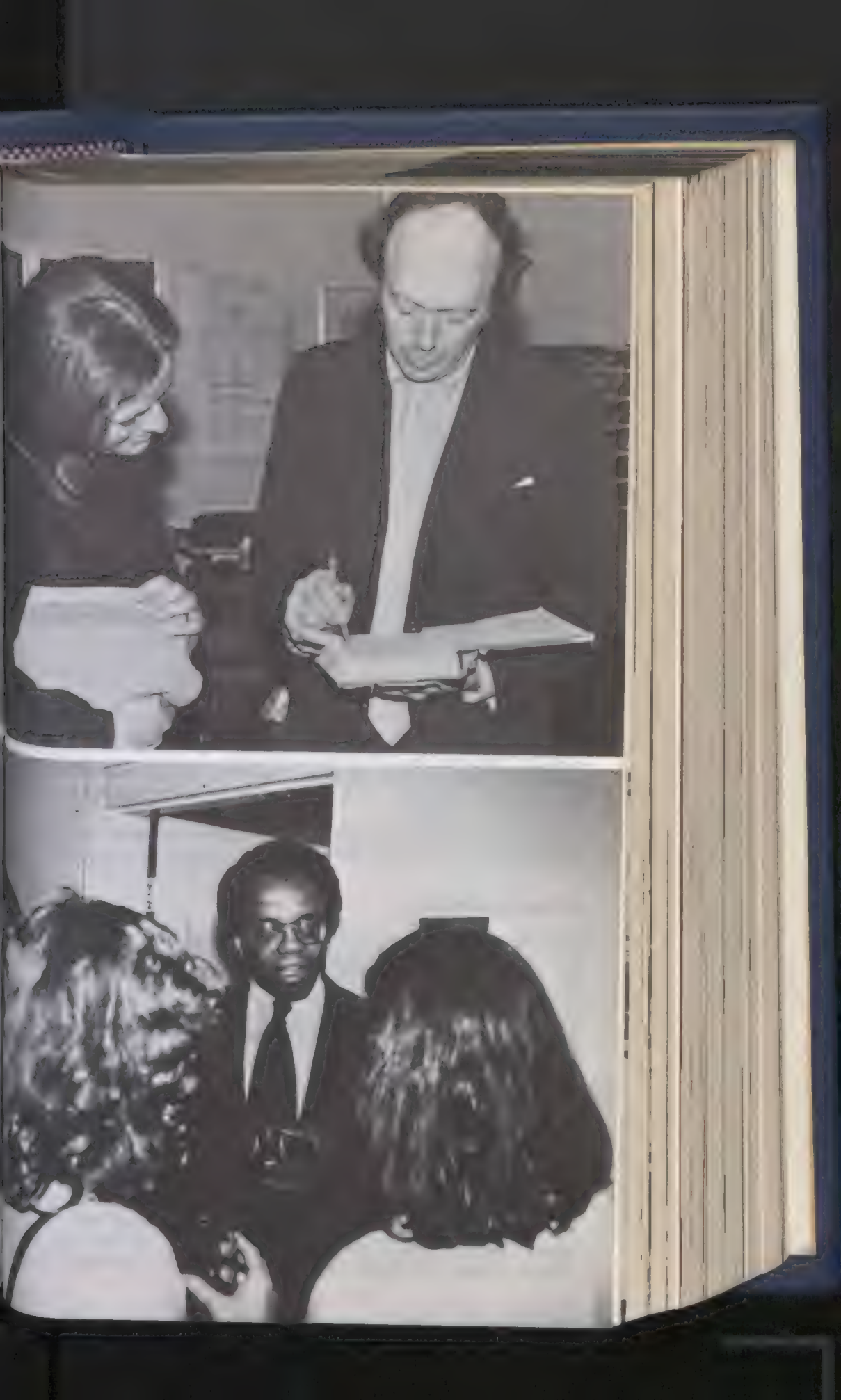
The Law Library of approximately 300,000 volumes, including microfilm holdings, is housed in the modern Jacob Burns Law Library Building, adjoining Stockton Hall on the south side. This facility comprises nine floor and deck levels with about 49,000 square feet of floor space. Its shelf capacity accommodates over 185,000 volumes; with supplementary shelving in Stockton Hall, a small branch of the Law Library for the use of the *Law Review* in Bacon Hall, and substantial storage space in Lisner Hall, the library provides space for approximately 300,000 volumes. Seating for more than 500 readers is provided in four reading rooms, lounge areas, carrels, enclosed study cubicles, semi-private reading alcoves, and seminar rooms.

The collections comprise a comprehensive working library of Anglo-American law, with supplementary material in related disciplines (such as business, finance, labor relations, sociology, criminology, political science, biography, foreign affairs, and others). Special areas are maintained for collections in tax law, labor law, patent-trademark-copyright law, international law, and foreign and comparative law. Included in the collections are the appellate decisions of all states courts and decisions of the federal courts, with comprehensive collections of English and Canadian court decisions; the currently annotated statutes of the 50 states; all federal statutes; English and Canadian statutes; selected statutes of other nations; and an extensive periodical collection, kept current by approximately 1,500 subscriptions, covering virtually all American legal periodicals and most of those published in English throughout the world. The library is strong in its treatise holdings, administrative and regulatory materials, and Congressional coverage. The growing international law holdings include collections of United Nations and European Economic Community printed material, all recent material from the International Labor Organization, and current and retrospective collections of international treaties. A large portion of the holdings of the former library of the Carnegie Endowment for International Peace, acquired by the University in 1950, is in the Law Library. A LEXIS terminal, providing computer-assisted research capability, is available to students and faculty. The Law Library is in the process of enlarging its videotape library to assist in Law Center instruction.

The Juris Doctor Degree Program

ENTRANCE REQUIREMENTS

For information on "Application for Admission" to the Juris Doctor degree program, see page 27. Admission to candidacy for the degree of Juris Doctor requires a Bachelor of Arts or equivalent degree from an accredited college or



university, a satisfactory quality of work, and an acceptable distribution of courses. Any substantial number of hours taken on a pass-fail or other ungraded basis may be seriously detrimental to an applicant's chances for admission. Eligibility is based on personal and scholastic records and on the result of the Law School Admission Test. Personal recommendations by the faculty, as well as the benefits the school derives from social, ethnic, cultural, and geographical diversity among its students, are considered. No applicant will be acceptable in transfer who is ineligible to return in good standing to a previously attended law school. From the applicants, a selection is made by the Committee on Admissions.

Information concerning the Law School Admission Test may be obtained from the Admission Office of the National Law Center or from the Law School Admission Services, Box 2000, Newtown, Pa. 18940. The test is administered at various centers in the United States. Testing dates are usually in October, December, February, and June. Completed application forms and fees must be received by the Law School Admission Services at least four weeks before the date of the test. It is not necessary that formal application for admission be made prior to taking the test.

ADVANCED STANDING

In unusual circumstances, advanced standing toward the degree of Juris Doctor may be granted for work of high quality successfully completed in other law schools which are members of the Association of American Law Schools or are approved by the American Bar Association. Transferred credits will not be recognized in excess of those which might be earned in a similar period in the National Law Center.

Advanced standing will not be granted for law work already counted toward the Bachelor of Arts or other pre-legal degree.

TUITION DEPOSIT

Every student admitted to the National Law Center as a candidate for the degree of Juris Doctor must submit a tuition deposit ($100 initially plus $350 later) after receipt of notification of acceptance. This deposit is credited toward tuition.

PROFILE OF THE ENTERING CLASS, FALL 1981

A first-year class of approximately 450 students was selected from approximately 6,000 applicants from 730 colleges and universities. Applications were received from every state in the union. Forty-five per cent of the first-year class were women.

The following colleges and universities are each represented by three or more members of the first-year class: American University, Barnard College, Boston College, Boston University, Brandeis University, Brigham Young University, Bucknell University, Catholic University of America, Clark University, Colgate University, College of William and Mary, Cornell University, Dartmouth College, Duke University, Emory University, Franklin and Marshall College, George Washington University, Georgetown University, Johns Hop-

kins University, Lehigh University, Miami University, Michigan State Univer-ity, Northwestern University, Oberlin College, Ohio State University, Pennsyl-ania State University, Rutgers University, Smith College, State University of ew York at Albany, State University of New York at Binghamton, State niversity of New York at Stony Brook, Syracuse University, Tufts Univer-ity, Tulane University, Union College and University, University of California, erkeley, University of Cincinnati, University of Colorado, University of lorida, University of Maryland, University of Massachusetts, University of ichigan, University of North Carolina, University of Notre Dame, Univer-ity of Pennsylvania, University of Pittsburgh, University of Rochester, Uni-ersity of Vermont, University of Virginia, U.S. Naval Academy, Wesleyan niversity.

HE CURRICULUM

he curriculum for the degree of Juris Doctor at the National Law Center ffers the candidate one of the largest and most varied selections of courses in he country. First-year students are required to take courses entitled Civil Pro-edure; Constitutional Law; Contracts; Criminal Law and Procedure; Legal Re-earch, Writing, and Professional Responsibility and Ethics; Property; and Torts. hese courses give students the basis upon which all further legal study is uilt. In the second and third years of study, students must take Evidence nd fulfill a two-credit legal writing requirement. Beyond these requirements he students are free to choose from the many course and project offerings. The aw Center prides itself on allowing students freedom to design their own rogram of study.

The curriculum is organized so that students may begin the study of law for he Juris Doctor degree only at the start of the fall semester. Transfer students ay enter at the start of the spring semester also.

ay Division

irst Year

FALL SEMESTER		SPRING SEMESTER	
ontracts I	4	Contracts II	2
orts	4	Property	4
riminal Law and Procedure	4	Constitutional Law	4
egal Research, Writing, and Profes-sional Responsibility and Ethics	2	Civil Procedure	4
otal semester hours	14	Total semester hours	14

econd Year

FALL SEMESTER		SPRING SEMESTER	
lective	14	Evidence	4
		Elective	10
otal semester hours	14	Total semester hours	14

Third Year

FALL SEMESTER		SPRING SEMESTER	
Elective	12	Elective	14
*Legal writing requirement	2		
Total semester hours	14	Total semester hours	14

Evening Division

First Year

FALL SEMESTER		SPRING SEMESTER	
Contracts I	4	Contracts II	4
Torts	4	Criminal Law and Procedure	4
Legal Research, Writing, and Professional Responsibility and Ethics	2	Civil Procedure	2
Total semester hours	10	Total semester hours	10

Second Year

FALL SEMESTER		SPRING SEMESTER	
Property	4	Constitutional Law	4
Elective	6	Elective	6
Total semester hours	10	Total semester hours	10

Third Year

FALL SEMESTER		SPRING SEMESTER	
Elective	8	Evidence	4
*Legal writing requirement	2	Elective	6
Total semester hours	10	Total semester hours	10

Fourth Year

FALL SEMESTER		SPRING SEMESTER	
Elective	10	Elective	10
Total semester hours	10	Total semester hours	10

Summer Term or Ninth Semester

Elective	4

*This requirement may be satisfied by service on the *Law Review*, by service as an editor of the *Journal of International Law and Economics*, by satisfactory completion of a seminar and other courses which require a research paper, by participation in upper class Moot Court, or by satisfactory completion of Law 344, *Legal Writing*.

REQUIREMENTS FOR THE DEGREE

The student must have completed a residence period of three academic years (four years for evening students) and 84 semester hours of required and elective courses, with a cumulative average of at least 65. At least one academic year of residence and 28 semester hours are required of students admitted with advanced standing. The work of the final semester or summer session must be completed while in residence at the National Law Center. Credits allowed for advanced standing are not included in computing the average required for graduation.

Graduation Requirements.—See page 42 for a statement of graduation requirements.

Residence

Candidates for the Juris Doctor degree must complete a residence period of three academic years. Attendance in the day division for the fall and spring semesters constitutes residence for an academic year; similar attendance in the evening division constitutes residence for three-fourths of an academic year. Consequently, a day student must attend six semesters to meet residence requirements; an evening student must attend eight. Students authorized to take schedules of less than 10 hours in the day division or less than six hours in the evening division receive residence credit on a proportional basis. Students who attend the summer sessions receive fractional residence credit.

HONORS

The degree of Juris Doctor "With Highest Honors" is awarded to those students, not exceeding three per cent of the graduating class, who have obtained the highest cumulative averages of at least 85 or better.

The degree of Juris Doctor "With High Honors" is awarded to those students with the highest cumulative averages of 80 or better. The number of students receiving degrees "With High Honors," when added to the total number of students receiving degrees "With Highest Honors," may not exceed 10 per cent of the graduating class.

The degree of Juris Doctor "With Honors" is awarded to those students with the highest cumulative averages of 75 or better. The number of students receiving degrees "With Honors," when added to the total number of students receiving degrees "With High Honors," and "With Highest Honors," may not exceed 40 per cent of the graduating class.

ORDER OF THE COIF

The Order of the Coif, a national legal honor society, aims "to foster a spirit of careful study and to mark in a fitting manner those who have attained a high grade of scholarship." The George Washington University Chapter was established in 1926. Members are elected each year from the highest-ranking ten per cent of the graduating Juris Doctor candidates. Only students who have completed their full course of study at the National Law Center are eligible for membership.

PUBLICATIONS

The *George Washington Law Review*, published five times a year, is edited and managed by the students of the National Law Center. The *Law Review* is known for its emphasis on federal and public law; however, it is also devoted to research in other important legal areas. The staff of the *Law Review* is selected on the basis of a writing competition and on the basis of grades. The editorial board is selected from those students who have successfully completed the first year of *Review* work. Students receive 4 semester hours of academic credit for the two-year program.

The George Washington *Journal of International Law and Economics*, managed and edited by law students, is a publication of the Law Center. It presents articles and commentaries on public and private international financial development, comparative law, and international law. The staff of the *Journal* is selected on the basis of grades and a writing competition, and students earn academic credit for their work.

MOOT COURT

The moot court competitions provide realistic training in appellate oral advocacy for students in the National Law Center. The Van Vleck Appellate Moot Court Board holds an upper-class competition in the fall and a first-year competition in the spring. There are also moot court competitions in specific areas of the law, including the Jessup International Law Moot Court, the Patent Law Moot Court, and the Wagner Labor Law Moot Court.

LAW CENTER ORGANIZATIONS

Asian American Law Student Association

A national organization, the Asian American Law Student Association serves the needs and concerns of Asian Americans.

The Advocate

The Advocate is the student newspaper of the National Law Center. It features articles by faculty and students on school news and current legal topics.

Black American Law Student Association (BALSA)

The Black American Law Student Association is a national Black law students organization which has chapters at some 80 law schools. BALSA sponsors law speakers and various programs.

International Law Society

The International Law Society is an organization of students interested in the practice of international law. The Society sponsors speakers and various programs.

Jewish Law Student Association

The Jewish Law Student Association sponsors a variety of speaker programs, including a Sunday brunch speaker series.

Movimiento Legal Latino

A national Latino law students organization which has chapters at various law schools, Movimiento Legal Latino sponsors law speakers and various programs.

Law Fraternities and Sororities

The chapters of Beta Kappa Pi, Delta Theta Phi, Phi Alpha Delta, and Phi Delta Phi at the National Law Center sponsor speakers and various social occasions.

Law Students Civil Rights Research Council (LSCRRC)

The Law Students Civil Rights Research Council is a national organization of law students concerned with the legal problems of civil rights. LSCRRC offers ethical law projects for which students may receive academic credit.

National Lawyers Guild

The George Washington Chapter of the National Lawyers Guild is designed to bring together those lawyers committed to broad issues of social reform.

Student Bar Association

The Student Bar Association is the law student governing body, responsible for allocating funds among the various student organizations. It also conducts a speaker program for the law school. All members of the student body are members of the Student Bar Association.



Student Intellectual Property Law Association

The Student Intellectual Property Law Association, an organization of students interested in patent, trademark, copyright, and related law, conducts an extensive speakers program as well as various social events.

Women's Rights Committee (WRC)

The Women's Rights Committee is primarily interested in the place of women in law schools and in the legal profession. WRC conducts seminars and sponsors speakers.

Joint Juris Doctor–Master's Degree Program

In certain instances, arrangements may be made for students to work concurrently toward both the Juris Doctor degree in the National Law Center and a Master's degree in some fields in the University's Graduate School of Arts and Sciences, School of Government and Business Administration, or School of Public and International Affairs. Fields in which this program is available include Business Administration, Economics, International Affairs, Political Science, Public Administration, and Public Affairs. Students must be admitted both to the National Law Center and, separately, to the School which will confer the Master's degree, and must meet all requirements in each degree program. It is possible for a student to complete work for both degree programs within four years.

Master's and Doctoral Programs

The administration of justice under law is a matter so vast and complex that some who hold the Bachelor of Laws or Juris Doctor degree feel the need for further study. The Master's and doctoral programs give students the opportunity to broaden and deepen their understanding of the law.

The Master of Laws candidate may follow a program of general study or concentrate in one of the specialized areas listed below. Courses in each of these areas are included in the 401–600 series. Graduates who complete their work in one of these areas may have the field of specialization noted on their diplomas.

Administrative Law: Economic Regulation
Corporation Law
Environmental and Energy Law
Government Procurement Law
International and Comparative Law
Labor Law
Land Use Management and Control
Law and Poverty
Law, Psychiatry, and Criminology
Patent and Trade Regulation Law
Taxation

Programs leading to the degree of Doctor of Juridical Science offer a limited number of unusually talented advanced students, who have already earned the Master of Laws degree, the opportunity to concentrate on research and writing in a specific area of interest to the legal profession.

MASTER OF LAWS

Entrance Requirements

A Bachelor of Laws, Juris Doctor, or equivalent degree from a law school which is a member of the Association of American Law Schools or is approved by the American Bar Association is required. The applicant must have demonstrated a high degree of academic excellence. Advanced standing is not granted for credits earned while a candidate for the first degree in law or for credits earned at other law schools.

Degree Requirements

The student must complete a residence period of not less than two semesters, which should be continuous. All requirements for the degree must be completed at this Law Center and in a period not exceeding three years from the time of initial graduate registration, unless an extension is granted in writing by the Dean. The student must complete 24 semester hours of courses and writing projects with acceptable grades. For all courses taken within the Law Center the student must attain the grade of 65 or above. For approved courses taken outside the Law Center, the grade of either *CR* (Credit) or *NC* (No Credit) is assigned. To receive the grade of *CR* (Credit) in a course taken in other graduate divisions of this University, a student is required to attain the grade of *B* or better. To receive the grade of *CR* (Credit) in a course taken at Georgetown University through the Consortium of Universities of the Washington Metropolitan Area, Inc., a student is required to attain the grade of *C* or better. A minimum cumulative average of 78 is required at all times for LL.M. candidates. The student is expected to include Law 599–600 *Thesis* in the 24-semester-hour requirement for the degree (for exception, see "Master's Thesis," below).

Candidates for the degree in a selected field of specialization must complete a minimum of 12 of the required 24 semester hours in courses and writing projects related to the selected field. Each Master of Laws program of study may include a limited number of courses numbered in the 300 series, with the approval of the Dean.

The only credit hours that may be applied to any Post-J.D. degree are those completed while a duly enrolled candidate for that specific degree, with the following exceptions: (1) an unclassified student who has been admitted with the specific right to convert to degree status at the end of a specified number of hours, and (2) S.J.D. candidates who have fulfilled the 8-hour course requirement as unclassified students.

MASTER'S THESIS

Each candidate for the degree of Master of Laws is expected to write a Master's thesis (Law 599–600) under the supervision of a full-time member of the faculty of the National Law Center. Four hours of credit will be granted for successful completion of the thesis. The purpose of this requirement is to demonstrate the ability of the student to perform research in a special area of

the law and to produce a scholarly paper containing the results of this research. The thesis is expected to be of substantially the same quality as a Law Review article. The Dean may waive the thesis requirement upon written request of the student, submitted no later than the beginning of the *final semester or summer session* before the student's graduation, provided the student has demonstrated research and writing ability by taking a minimum of 6 semester hours of course work at the National Law Center designated "Research Paper." No thesis waiver is granted for candidates for the degree of Master of Laws with specializations in international law or government procurement law.

The thesis in its final form must be presented to the adviser no later than the date specified in the Calendar. Two complete copies are required. It is the responsibility of the candidate to obtain from the Post-J.D. Programs Office a printed copy of the regulations governing the styling and reproduction of theses. The mandatory thesis binding fee of $15 must be paid at the time of registration for the last semester's work.

Accepted theses become the property of the University and are placed in the University Library and the Law Library, where the duplicate copies are bound and made available for circulation.



Honors

The degree of Master of Laws "With Highest Honors" is awarded students who obtain a minimum cumulative average of 85.

Graduate Courses in Other Departments

Master of Laws candidates may be permitted to take graduate courses related to their fields of interest in other departments of this University. A maximum of 6 semester hours will be credited toward the degree for such courses; however, credit will be granted only if the courses are given on campus. The grade of *CR* (Credit) or *NC* (No Credit) will be recorded for such courses. Courses numbered 101–200 may be taken for graduate credit only if the student receives the approval of the instructor at the time of registration and does additional work, as prescribed by the department offering the course.

Consortium of Universities of the Washington Metropolitan Area, Inc.

A candidate for the Master of Laws degree may take graduate courses at Georgetown University Law Center through the Consortium of Universities of the Washington Metropolitan Area, Inc. A maximum of 6 semester hours of such courses may be credited toward the degree. Permission to take Consortium courses must be granted by the Dean, the Registrar, and the instructor offering the course. The grade of *CR* (Credit) or *NC* (No Credit) will be recorded for such courses. To receive the grade of *CR* a student must attain a grade of *C* or higher.

DOCTOR OF JURIDICAL SCIENCE

Entrance Requirements

Admission to candidacy for the degree of Doctor of Juridical Science requires a Bachelor of Arts or equivalent degree from an approved college or university; a Bachelor of Laws, Juris Doctor, or equivalent degree, earned with high rank, from a law school which is a member of the Association of American Law Schools or is approved by the American Bar Association; a Master of Laws degree with high academic standing; outstanding capacity for scholarly work in the field of law; and faculty approval of the applicant's dissertation topic. Applicants must also demonstrate their writing ability by submitting the Master's thesis or a copy of one or more papers or articles which the applicant has written. Following consultation with the Dean, the applicant must obtain a faculty adviser, to be designated "committee chairman," from the regular, full-time faculty; reach agreement on the acceptability of the proposed topic for the dissertation; and submit a detailed outline for the adviser's approval, indicating by chapter and division within chapter the exact scope of the project. There should be a bibliography for each chapter, listing books, reports, cases, and law review articles to be considered. Although the outline cannot predict every detail of the subsequent research, it must be sufficiently definite to afford the Graduate Board a basis for evaluation.

Once the outline is approved, the applicant's "committee" is expanded to three members; this consultative committee must recommend the acceptance of the applicant to the full Graduate Board. The Board then acts upon the recommendation and may either accept or reject the applicant as an S.J.D. candidate. In no instance will any applicant be admitted to degree candi-

dacy prior to the above procedures; however, the applicant may be registered as an Unclassified Student for purposes of course work requirements (see below). Approval for degree candidacy must be received within one year of the appointment of an adviser unless a written extension is granted by the Dean.

Degree Requirements

The candidate must complete (1) a residence period of not less than one academic year; (2) a course of study and research—designated by the consultative committee and approved by the Graduate Board—of no less than 8 semester hours including *Jurisprudence*, unless previously taken; and (3) an acceptable dissertation. The dissertation must be submitted no later than three years from the date of admission to candidacy for the S.J.D. degree. The applicant who proposes to write on a comparative law topic must have a reading knowledge of the language in which the relevant materials are to be found. When the dissertation is submitted, the consultative committee will set the date for an oral examination. This examination is conducted by the consultative committee and such other members of the faculty and qualified experts as are selected by the Graduate Board.

No later than the date specified in the Calendar (see page 5), the candidate must submit to the Dean two complete copies of the dissertation and two copies of an abstract (not to exceed 600 words) of his dissertation.

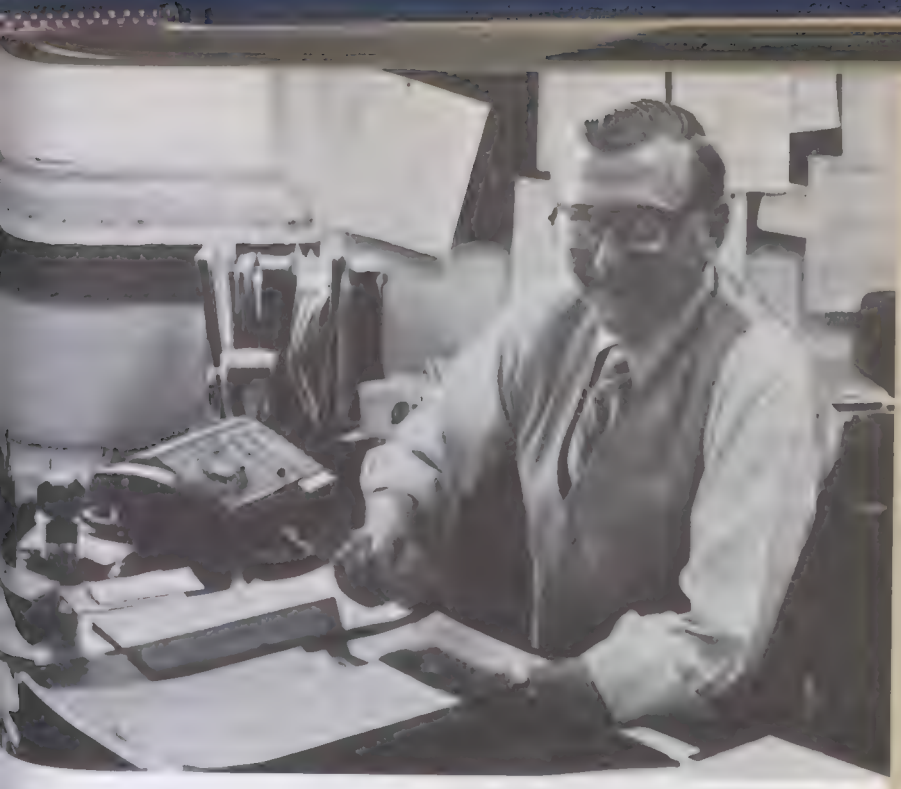
Printed copies of detailed regulations regarding the form and reproduction of the dissertation and preparation of the abstract are available in the Office of the Dean. To be acceptable the dissertation must, in the opinion of the examining committee, constitute a substantial contribution to the field of law concerned and be suitable for publication. Additional information will be supplied by the Dean. Accepted dissertations become the property of the University and are placed in the University Library and the Law Library, where the duplicate copies are bound and made available for circulation.

Degree Programs for International Students

The National Law Center has several programs of study available to students trained in law outside the United States. These programs fall into two general categories: (1) those directed toward preparing students for a bar examination in an American jurisdiction and (2) those that enable students to return to their countries with a more thorough understanding of some aspects of American law.

A student with a degree from a foreign law school who has met the extremely competitive admissions criteria will be admitted to the Center as a candidate for the Master of Comparative Law (Foreign Practice) (M.Comp.L. [For. Prac.]) or Master of Comparative Law (American Practice) (M.Comp.L. [Am. Prac.]) degree.

To prepare for admission to the bar of an American jurisdiction, the student may apply for either the Juris Doctor or the Master of Comparative Law (American Practice) degree. The J.D. degree requires 84 semester hours of work in law school (credit is given for work in a foreign law school only in ex-



ptional circumstances) and will qualify the student to take most U.S. bar aminations. The M.Comp.L.(Am.Prac.) degree requires 32 semester hours work and satisfies the requirements of the District of Columbia Bar. *Students e cautioned to ascertain the requirements of the bar for which they intend to alify prior to selection of their law school programs.*

Foreign students planning to return to their home countries may undertake a ogram leading to the degree of Master of Comparative Law (Foreign Prac-e). This degree program enables the student to gain a broader comprehension the American legal system by taking basic courses in the Law Center. How-er, it is not intended to qualify a student to take a U.S. bar examination.

MISSION PROCEDURE

plication must be received from *foreign applicants* no later than June 1 the fall semester (March 1 for candidates for the Juris Doctor degree), vember 1 for the spring semester, and March 1 for the summer sessions.

uired Records

plicants must request all educational institutions attended to send directly the Dean official credentials listing subjects studied, grades received, exam-ations taken, and degrees received. Original diplomas, certificates, and nscripts from secondary schools and all colleges and universities attended required, but in exceptional cases certified copies will be accepted. Records state examinations and certificates are also needed. All records become the perty of the University and *cannot* be returned.

Language Test

Students whose native tongue is not English are required to take the *Test of English as a Foreign Language* and attain as an absolute minimum the score of 550 to be considered for admission to the National Law Center. This is a mandatory requirement. Students are responsible for making arrangements for taking the test and should address inquiries to TOEFL, Educational Testing Service, Princeton, New Jersey 08540, U.S.A. The completed application form should be returned to the Testing Service at Princeton well in advance of the beginning of the semester for which the applicant seeks admission. The test fee, which should be remitted with the application, entitles the student to have the test score sent to three different institutions. Registration for the *Test of English as a Foreign Language* does *not* constitute application for admission to George Washington University.

The Bulletin of Information, obtainable without charge, contains a description of the test as well as rules regarding application, fees, reports, and the conduct of the test; lists of examination centers; examination dates; and an application blank. On the application for the test, the student should specify that the scores be sent to the Dean's Office.

ENTRANCE REQUIREMENTS

For the Degree of Juris Doctor.—Entrance requirements for foreign students are the same as those stated on pages 10–12, except that advanced standing is rarely granted for study in foreign law schools.

For the Degrees of Master of Comparative Law (Foreign Practice) and Master of Comparative Law (American Practice).—The entrance requirements are the successful completion of and graduation from a course in arts, philosophy, letters, or sciences, equivalent to graduation from a gymnasium, lycee, or liceo; and graduation in law with high academic standing from a recognized foreign university.

For the Degree of Master of Laws.—A foreign student will only be considered for admission to the Master of Laws program if he or she has a juris doctor or post-juris doctor degree in law with high academic standing from an American university.

For the Degree of Doctor of Juridical Science.—The usual entrance requirements are the successful completion of and graduation from a course in arts, philosophy, letters, or sciences, equivalent to graduation from a gymnasium, lycee, or liceo; graduation in law from a recognized foreign university; outstanding capacity for scholarly work in the field of law; and a Master of Laws degree with high academic standing from an American university.

DEGREE REQUIREMENTS

Juris Doctor, Master of Laws, Masters of Comparative Law, and Doctor of Juridical Science.—Degree requirements for foreign students are the same as those stated on pages 15, 19–20, and 21–22.

Master of Comparative Law (Foreign Practice).—The student must complete a residence period of not less than two semesters, which should be continuous

All requirements for the degree must be completed in a period not exceeding three years from the time of registration for the degree. The student must complete satisfactorily 24 semester hours of approved courses of the Center, or of such other departments of the University as the faculty of the Center shall approve, and must maintain a cumulative average of at least 65.

Master of Comparative Law (American Practice).—The requirements for this degree are the same as those for the degree of Master of Comparative Law (Foreign Practice) except that this degree requires 28 semester hours of course work with a cumulative average of at least 65. For those students admitted on or after the 1979 Fall semester, 32 semester hours of course work with a cumulative average of at least 65 will be required.

Unclassified Students

Two types of students may be admitted to the National Law Center as Unclassified Students, in accordance with the following regulations:

1. A candidate for a Bachelor of Laws or Juris Doctor degree with an above-average record at another law school which is a member of the Association of American Law Schools or is approved by the American Bar Association may, in the discretion of the Dean, be admitted as an Unclassified Student to earn credits for transfer to the other law schools. Such students are normally admitted only to the summer sessions. They are admitted to the fall or spring semester only in unusual circumstances.

2. Graduates of law schools which are members of the Association of American Law Schools or are approved by the American Bar Association who wish to take advanced courses without pursuing degree programs may be admitted as Unclassified Students.

Unclassified Students participate in the work of the course, take examinations, and have their grades recorded. Credit for work earned as an Unclassified Student may not be applied to satisfy the requirements for a degree program unless express written approval is granted by the Dean at the time of admission.

Continuing Legal Education

Members of the Bar wishing to keep abreast of current developments in the law may register for any of the courses in the National Law Center on a non-credit basis as Continuing Legal Education students. Such students do not take examinations in courses and no grades are recorded for their work.

A simplified admission and registration procedure is used and must be completed on or before the last day of regular registration for the appropriate semester. Continuing Legal Education students pay only the tuition fee on the semester-hour basis. They may not participate in student activities or benefit from the medical privileges of the University. (Continuing Legal Education registrations are subject to cancellation if courses are filled by regularly registered students.)



GENERAL INFORMATION

The National Law Center has an enrollment of about 1,700 for the J.D. and Post-J.D. degree programs. Approximately 1,000 students are enrolled in the full-time day division for the J.D. degree and 400 are enrolled in the part-time evening division. Three hundred students, many from abroad, are enrolled in the Post-J.D. degree programs.

DAY AND EVENING CLASSES

Day classes meet in the mornings in 50-minute periods and in the afternoons in 75-minute periods and also in sessions of two 50-minute periods, Monday through Friday. Trial Practice Court and certain other courses meet for two-hour periods on Saturday mornings.

Evening classes meet from 5:50 to 7:40 p.m., Monday through Friday. A four-credit course, e.g., Evidence, meets two evenings a week; a three-credit course, e.g., Administrative Law, meets two evenings a week for one-half the semester and one evening for the other half; a two-credit course, e.g., Contracts II, meets one evening a week. The evening division conforms to the standards of the day division, the full-time faculty participating in the instruction.

Examinations for both day and evening classes may be given in the afternoon only. Examinations for day students may be given in the evening.

SUMMER TERM

A term of two sessions, with day and evening classes, is offered in the summer. Students may register for either or both sessions. *No beginning students are admitted to the Juris Doctor program in the summer term.*

The summer term is shorter than a semester of the academic year, and, as a consequence, a student must attend two and one-half summer terms to receive residence credit for one academic year or attend one and one-half summer terms to receive residence credit for a semester.

A maximum of 6 semester hours may be taken each session by day students. Day students receive four-tenths of a semester of residence credit for each session of the summer term in which they are registered for 3 or more semester hours. A maximum of 4 semester hours may be taken each session by evening students. Evening students receive three-tenths of a semester of residence credit for each session of the summer term in which they are registered for 2 or more semester hours.

Admission

Applicants are urged to submit application forms and complete credentials well in advance of the semester for which they seek admission. In the selection process, there is no discrimination against any applicant because of sex, race, color, religion, handicap, or national origin. An application fee of $30 for a degree candidate ($15 for an unclassified student) must accompany the application.

Forms for application for admission or readmission are available at and should be returned to the Office of Admissions of the National Law Center, George Washington University, Washington, D.C. 20052.

For further details concerning students from foreign institutions, see pages 22–24.

APPLICATION FOR ADMISSION

Juris Doctor Program.—Beginning students are admitted only at the start of the fall semester.

The applicant should register with the Law School Data Assembly Service (LSDAS) by completing and mailing the registration form supplied by the Law School Admission Services (LSAS). No application to this school will be processed unless accompanied by a Law School Application Matching Form, which is found in each applicant's LSAT LSDAS registration packet. Since an LSAT and/or LSDAS report cannot be produced by LSAS without the Matching Form, it will be necessary to return to the applicant any application received without it. A transcript from each college or university attended should then be sent directly to LSAS, Box 2000, New Town, Pennsylvania 18940. No transcript should be sent to the National Law Center. The LSDAS will analyze the transcript and send a copy to this law school and others designated on the registration form. If the transcript that has been forwarded to LSDAS does not show evidence of receipt of a Bachelor's degree, the applicant will be asked, upon acceptance, to submit a final transcript directly to the National Law Center.

To provide time for the evaluation of credentials of beginning students, all papers, including the Law School Admission Test score, should be received by the National Law Center before March 1. This means that the October or December Law School Admission Test should be taken (see "Entrance Requirements," pages 10–12).

All applications of transfer students should be received by the Admissions Office no later than June 1 for the fall semester, December 1 for the spring semester, May 1 for the first summer session, and June 1 for the second summer session.

For additional information, see the official *Pre-Law Handbook* prepared by the Law School Admission Council and the Association of American Law Schools. The Handbook includes material on the law and lawyers, pre-law preparation, applying to law schools, and the study of law, together with individualized information on most American law schools. It may be obtained at college bookstores or ordered from Law School Admission Services, Box 2000 New Town, Pennsylvania 18940.

Master's and Doctoral Programs.—Students are admitted at the beginning of the fall semester, the spring semester, or any of the summer sessions.

Application for admission, together with all required credentials, must be received by July 1 for the fall semester, November 1 for the spring semester, and one month prior to registration for the summer session for which application is made.

Unclassified Students.—Lawyers who wish to take graduate courses are admitted at the beginning of the fall semester, the spring semester, or any of the summer sessions. Students who wish to earn credits for transfer toward a

achelor of Laws or Juris Doctor degree at another institution may be admitted the summer sessions if they are students in good standing at an accredited w school and have shown unusual ability in their law studies; they are admitted to the fall or spring semester only in unusual circumstances.

1. Application for admission, with required credentials, for a student who shes to earn credits for transfer toward a Bachelor of Laws or Juris Doctor egree at another law school (see page 25), should be received at the Office of missions of the National Law Center at least one month prior to the first day registration for the semester or summer session for which application is ade.

2. Application for admission, with required credentials, for lawyers who wish take graduate courses (see page 25), should be received at the Office of Admissions of the National Law Center by July 1 for the fall semester, November for the spring semester, and one month prior to registration for the summer sion for which application is made.

ADMISSION

student who was previously registered but did not attend during the most ent semester (summer term excluded) should file an application for readsion. Closing dates for readmission are the same as those for admission e "Application for Admission," page 28).

If the student has attended one or more higher institutions during his abce from the University or if he applies as a degree candidate and was previsly a nondegree student, he must have complete, official transcripts sent to e Dean.

gistration

fore attending classes each student must register in person. No student will registered until proper credentials have been filed and approved (see "Admission").

No registration is accepted for less than a semester or one summer session.

student may not register concurrently in George Washington University another institution. Registration in more than one college, school, or divi of the University requires the written permission of the deans concerned, *or to registration.*

GIBILITY FOR REGISTRATION

tudent who is suspended or whose record is not clear for any reason is not ible to register.

ew Student.—Upon receipt of a *final letter* of admission a new student is ble for registration on the stated days of registration.

eadmitted Student.—A student previously registered who was not registered courses during the preceding semester or summer session must apply for receive a letter of readmission (see "Readmission," above) before becomligible for registration.

DATES AND PLACE OF REGISTRATION

Registration is held in Stockton Hall, 720 Twentieth Street, N.W., during the following periods: *fall semester,* August 19 and 20; *spring semester,* January 6 and 7.

A late-registration fee of $15 is charged each student who is permitted to register after the regular registration days.

Registration may be changed only with the permission of the Dean.

Fees and Financial Regulations

The following fees and financial regulations were adopted for the 1982 summer sessions and the 1982–83 academic year.

Tuition Fees

J.D. candidates:	
Full-time program (11 or more hours*), each semester	$3,050.00
Part-time program, each semester hour	218.00
Master's degree candidates (LL.M., M.Comp.L., and M.Comp.L. (Am. Prac.)) and Continuing Legal Education students, each semester hour	200.00
S.J.D. candidates,† full program, including the final examination	6,200.00

University Center Fee (charged all students registered on campus)

Students registered for 11 or more semester hours: Each semester	60.60
Students registered for less than 11 semester hours: Each semester hour for which the student registers	5.75
Graduation Fee	25.00

Special Fees

Application fee (degree candidate), nonrefundable	30.00
Application fee (unclassified student), nonrefundable	15.00
Application fee (unclassified post-J.D. summer student), nonrefundable	10.00
Tuition deposit fee charged each student admitted to J.D. degree candidacy (payable in two installments—$100, nonrefundable, by a date specified in the letter of admission, $350 by June 1)	450.00
Fee for binding Master's theses and S.J.D. dissertations	15.00
Late-registration fee, for failure to register within the designated period	15.00
Late-payment fee, charged for failure to make payments when due (see "Payment of Fees," below)	15.00
Replacement of lost or stolen picture identification card	2.00
Financial reinstatement fee, for reinstatement after financial encumbrance for nonpayment of fees (see "Payment of Fees," below)	35.00

* With the prior permission of the Dean, a J.D. degree candidate may take more than 14 semester hours after the first year of study.

† The tuition fee is to be paid at the rate of $1,550 per semester for four successive semesters, exclusive of the summer term or terms. If the Faculty should approve an extension of time, the student must maintain continuous enrollment.

Returned check fee, charged a student whose check is returned because of insufficient funds or for any other reason 15.00
Transcript fee 2.00
If two or more transcripts are requested at the same time, fee for each of the first two copies is $2; fee for each additional copy ..... .50

Registration on campus in the University entitles each student to the following privileges: the services of the Student and Alumni Career Services Office; the use of the University Library; gymnasium privileges; admission to all athletic contests, unless otherwise specified; subscription to the *University Hatchet*, the student newspaper; admission to University debates; medical attention as described under Student Health Service. These privileges terminate and a student is no longer in residence upon withdrawal or dismissal from the University.

PAYMENT OF FEES

No student is permitted to complete registration or attend classes until all charges are paid or until arrangements for payment have been made. Tuition and fees for each semester are due and payable in full at the Office of the Cashier at the time of each registration. Checks and postal money orders should be made out to George Washington University with student identification number shown in upper left hand corner.

The Student Accounts Office has responsibility for billing and maintaining student accounts for tuition, various fees, and room and board charges. Students registered for 6 semester hours or more may sign a deferred payment contract with the Student Accounts Office at the time of each registration permitting them to pay one-half of the total tuition and fees (except for fees payable in advance) at the time of registration and the remaining half on or before Wednesday of the ninth week of classes for the fall and spring semesters. Interest at the rate of 8 per cent per annum on the unpaid balance will be charged from the date of registration to the date payment is made. A 10-month payment plan is also available.

Students receiving tuition assistance in the form of scholarships, government tuition contracts, or other forms of tuition awards are not permitted to sign deferred payment contracts unless the total tuition and fee charges exceed the value of the tuition awards by $1,200 or more. Under such circumstances the student may be permitted to pay one-half of the amount due from the student at the time of registration and to defer the balance by signing a deferred payment contract.

Students who fail to make any payment when due will be automatically charged a $15 late-payment fee and will be subject to the interest charge of 8 per cent per annum. Accounts which become 30 days past due will be financially encumbered. In the event a student's account is financially encumbered, the student forfeits his right to the use of deferred payment contracts in future semesters, and the Student Accounts Office will notify the Registrar to withhold grades, future registration privileges, transcripts, diplomas, and other academic information until the account is settled financially. Financial settlement will require payment in full of all amounts due the University in addition to a financial reinstatement fee of $35.

Returned Checks—A student whose check is returned unpaid by the bank for any reason will be charged a returned check fee. If the check is not paid within 15 days, the student will forfeit all rights to check cashing at the Uni-

versity, and future payments for tuition, dormitory, food service, and other special fees will require payment by cash, certified check, or money order.

PREPAID AND DEFERRED PAYMENT PLANS

Several commercial programs for those who wish to pay for college on a monthly basis are available. Terms and conditions vary, but most provide a life insurance policy in the contract. For specific details and applications, address inquiries to the following:

1. Girard Edu-Check Plan, 2nd and Chestnut Streets, Philadelphia, Pa. 19106
2. Richard C. Knight Insured Tuition Payment Plan, 6 St. James Avenue, Boston, Mass. 02100
3. The Tuition Plan, Inc., Concord, N.H. 03301

The University's Office of Student Financial Aid does not maintain a supply of applications for these various programs, but will be happy to provide guidance to students and parents.

WITHDRAWALS AND REFUNDS*

Applications for withdrawal from the University or for change in class schedule must be made in person or in writing to the Dean. Withdrawal from courses is permitted after the midpoint of a semester only in extraordinary circumstances. Notification to an instructor is not an acceptable notice.

In authorized withdrawals and changes in schedule, cancellations of semester tuition charges and fees will be made in accordance with the following schedule for the fall and spring semesters:

1. *Complete withdrawal* from the University:
   Withdrawal on or before Saturday of the first week of classes 90%
   Withdrawal on or before Saturday of the third week of classes 75%
   Withdrawal on or before Saturday of the fifth week of classes 50%
   Withdrawal after the fifth week of classes .....None
2. For a *change in status from full-time to part-time student* or for *partial withdrawal by a part-time student*, the above schedule applies to the difference between charges for the original program and the adjusted charges for the revised program.
3. A student enrolled in a full-time program who drops or adds a course and continues to be in a full-time program will have no financial adjustments of tuition made other than those involving course fees.
4. Regulations governing student withdrawals as they relate to residence hall and food service charges are contained in the specific lease arrangements.

Refund policies of the University are in conformity with guidelines for refunds as adopted by the American Council on Education.

* No refund of the $100 deposit required of entering students is granted. Regulations covering withdrawal and refunds for the summer sessions are stated in the *Summer Sessions Schedule of Classes.*

In no case will tuition be refunded or reduced because of absence from classes.

Authorization to withdraw and certification for work done will not be given student who does not have a clear financial record.

Students are encouraged to provide their own cash funds until they can make banking arrangements in the community.

Financial Aid

The National Law Center has been able in recent years to assist many students in obtaining the financial aid they require, through full or partial scholarships, various loan programs, part-time employment, or a combination of these kinds of assistance.

GRADUATE AND PROFESSIONAL SCHOOL FINANCIAL AID SERVICE

The National Law Center participates in the Graduate and Professional School Financial Aid Service (GAPSFAS), which provides an analysis of an applicant's financial needs. Entering students wishing to receive financial aid should request the materials from GAPSFAS, Educational Testing Service, Box 2614, Princeton, New Jersey 08541. The information provided by the applicant and the applicant's parents will be analyzed, and a copy of the report will be sent to the Law Center. In addition, students entering the National Law Center who desire to be considered for a scholarship must submit a letter to the Law Center by March 1 outlining their academic qualifications, their extracurricular activities, and their reasons for believing a scholarship award to them is justified.

Students needing financial assistance should file with GAPSFAS in time for their reports to be received at the Law Center as early as possible since the Committee on Student Financial Aid of the Center will begin making awards in March, and available funds are limited.

No awards will be made to an entering student until the admission process has been completed.

JURIS DOCTOR PROGRAM

Scholarships and Research Assistantships

Application and correspondence concerning scholarships and research assistantships should be sent directly to the Dean. Unless otherwise specified, application and supporting credentials should be submitted no later than March 1 preceding the period for which the award is made.

Arent, Fox, Kintner, Plotkin & Kahn Scholarship (1973).—Scholarship aid for needy law students from the Washington, D.C., area.

Mildred Gott Bryan Scholarship Fund (1965).—Partial scholarship aid for students in the National Law Center.

Charles Worthington Dorsey Memorial Scholarship (1947).—Memorial to Charles Worthington Dorsey, LL.B. 1881, LL.M. 1882. A full-tuition scholar-

ship for the course leading to the degree of Juris Doctor, awarded to a needy and promising graduate of this University with a Bachelor of Arts or equivalent degree. Ordinarily this scholarship is awarded once every three years.

Honor Scholarships.—Two scholarships available each year to students entering upon full-time study. Each scholarship provides a cash award, in addition to tuition aid, in an amount depending on need, for all three years. These scholarships are awarded on the basis of outstanding college records, both academic and extracurricular; Law School Admission Test scores; and need. To retain the scholarship for the second and third years, the candidates must maintain a *B* average, both for each year and cumulative.

Hunton and Williams Scholarship (1981).—An annual award of $1,000 given by the law firm of Hunton and Williams in recognition of the quality of the legal education offered at this law school.

Law Center Tuition Remission.—For Juris Doctor students, based on financial need.

Phi Delta Delta Scholarships (1959).—Zeta Chapter of Phi Delta Delta Legal Fraternity (International), provides tuition aid to a student in the second year of the Juris Doctor program who excelled in scholastic achievement and service to the Center in the first year.

Vernon Romney Scholarship Fund (1977).—To provide a scholarship to some worthy student in the Law School.

Trustee Scholarships.—Scholarships awarded each year to entering full-time students, for tuition aid, in amounts depending on need. Candidates must have demonstrated qualities of leadership, in addition to scholastic attainment. To retain the scholarship, the successful candidate must maintain a *B* average, both for each year and cumulative. Application must be made to the Dean before March 1.

Tuition-aid scholarships are also available to continuing second- and third-year full-time students with demonstrated scholastic ability, on the basis of financial need and capacity for leadership. Application should be made to the Dean prior to June 1.

Frank S. Whitcomb Scholarship Fund (1971).—Bequest of Frank S. Whitcomb for the purpose of aiding and assisting worthy young men and women in securing a legal education.

Graduate Fellowship Information Center.—Students may also wish to visit the Graduate Fellowship Information Center (2025 H St., N.W.) for additional information on fellowships and grants.

Loan Funds

Through the generosity of friends of the University a number of loan funds are available. Among them are the Lyle T. Alverson Loan Fund; the Robert Ash Loan Fund; the George R. Beneman Loan Fund; the Morris and Gwendolyn Cafritz Foundation Minority Law Student Loan Fund; the Robert M. and Mary McConnel Cooper Loan Fund; the Robert McKinney Cooper Memorial Loan Fund; the J. Forrester Davison Loan Fund; the District of Columbia Bar Association Loan Fund; the J.W. Ehrlich Foundation Loan Fund; the Newell W. Ellison Loan Fund; the Harold L. and Violet George Foundation Loan Fund; the George Washington Law Association Loan Fund; the

Morris Golub Loan Fund; the Jephson Educational Trust Loan Fund; the Law Association Loan Fund for the law classes of 1912, 1918, 1921, 1924, 1929, 1931, 1933, 1935, 1936, 1937, 1938, 1939, 1941, 1942, 1945, 1950, 1951, 1952, 1953, 1955, 1959, 1960, 1961, 1962, 1963, 1964, 1965; the Law School Loan Fund; the Oscar Lawler Memorial Loan Fund; the Horace L. Shines Memorial Assistance Fund; the Jessie B. Martin Loan Fund; the Robert N. Miller Loan Fund; the Joan Murphy Loan Fund; the Mike Pelekiri Loan Fund; the Phi Delta Delta Loan Fund; the W. Theodore Pierson Loan Fund; the Rockport Loan Fund; the Samuel L. Samuel Loan Fund; the H. William Tanaka Law Students Assistance Loan Fund; the Orville Hassler Walton Memorial Loan Fund; the W.H. Williams Memorial Student Loan Fund; the Ruth F. Wilson Loan Fund; and the Yadao and Kanemoto Loan Fund.

In addition, financial assistance is available through the Guaranteed Student Loan Program, National Direct Student Loans, and other sources.

Application for financial assistance should be made in the Office of the Dean.

MASTER'S AND DOCTORAL PROGRAMS

Fellowships and Scholarships

Application should be made before March 1 preceding the period for which the award is made. The applicant should submit an application for admission as a degree candidate and a personal letter applying for a fellowship to the Dean. The letter of application should contain complete biographical data, information as to experience in practice or teaching, and copies of or citations to published legal writings, and such other information the student believes will be of assistance in the consideration of the application. Applicants should arrange for letters of recommendation to be sent from two members of their law faculty directly to the Dean. The applicant's academic rank in class should be included either in the transcript of the law school or in the letters of recommendation.

Marcus B. Finnegan Memorial Fellowship.—Established in memory of Marcus B. Finnegan, LL.M. '57, who, as an alumnus, lawyer, and teacher, brought distinction to the field of patent law. The Fellowship was established in 1979 by generous gifts by Mr. Finnegan's law firm, Finnegan, Henderson, Farabow, Garrett & Dunner, his clients, and his many friends. The income from the Fellowship is used to finance a Graduate Fellowship in Intellectual Property with the requirement that the recipient of the Fellowship prepare a publishable paper in the field of international intellectual property.

Richard Paul Momsen Scholarships for Brazilian Graduate Law Students.—Bequest of Richard Paul Momsen, LL.B. 1912. Awarded 1980–81 and alternate years, for the study of U.S. constitutional law and the law of patents and trademarks.

Teaching Fellowships.—Three or four fellowships available each year with a stipend of $8,000 plus tuition for an approved course of study leading to an advanced degree. Teaching fellowships are awarded for a term of two academic years. Fellows conduct the first-year course in Legal Research and Writing and work with the students to improve their legal writing ability. By arrangement with the Dean, they may also be given the opportunity to teach additional courses.



Prizes

Jacob Burns Prize.—Established by Jacob Burns, a law alumnus and Trustee of the University. A medal and $100 awarded annually to each of the two members of the winning team in the upperclass Van Vleck Moot Court competition.

The Michael D. Cooley Memorial Prize.—A plaque and a cash award given to that individual in each graduating class who has been most successful in maintaining his or her compassion, vitality, and humanity during law school. The recipient of this award is selected by the graduating class during the spring of the third year at the National Law Center.

Ogden W. Fields Graduate Prize.—Awarded annually to the graduate student who has demonstrated the highest overall proficiency in a course in labor law.

Charles Glover Prize.—Established by Charles Carroll Glover, Jr., an Honorary Trustee of the University, in memory of his great-grandfather, an illustrious member of the bar of the District of Columbia. A cash award given annually to the student who has attained the highest average grade in the third-year, full-time course.

Kappa Beta Pi Prize.—Awarded by Eta Alumnae Chapter to the law student who attains the highest average for the first year.

John Bell Larner Prize.—By bequest, a medal awarded annually to the member of the graduating class who attains the highest average grade in the entire course for the degree of Juris Doctor.

John Ordronaux Prizes.—By bequest, awarded annually to the student who has attained the highest average grade in the first-year, full-time course; and $75 to the student who has attained the highest cumulative average grade at the end of the second-year, full-time course.

United States Law Week Award.—Presented to an outstanding senior law dent.

Jennie Hassler Walburn Prize.—A cash award to the outstanding student in field of civil procedure, established by the will of the late Professor Orville sler Walburn in memory of his mother.

egulations

CADEMIC WORK LOAD

Juris Doctor Candidates.—Juris Doctor candidates without substantial out- e employment may take a program of studies of 14 hours a week. Such stu- ts may take courses in the evening only if they are not scheduled in the day- e and if a majority of the hours taken are in day courses. The Dean is thorized to approve programs of study of more than 14 hours in exceptional es; however, no program will be approved which would permit the student complete requirements for the degree in less than 28 months after beginning first year of law study. Students with more than 20 hours of outside employ- nt, whether in the day or evening division, must take a limited program of dies not exceeding 10 hours a week. Students taking a majority of their ses in the evening may not take more than 10 hours a week; the minimum d is 8 hours, except in special cases where 6 may be approved by the Dean a limited time. A minimum schedule of 11 hours in the day division is uired except in exceptional circumstances when a reduced program is au- rized by the Dean.

Students taking more than 8 hours in the day division or 4 hours in the ning division must have the permission of the Dean to take a Bar Review rse.

Students may transfer from the day division to the evening division only h the permission of the Dean.

With the approval of the Dean, second- and third-year students may take a imum of 6 semester hours of appropriate courses in other departments of University; such a student must receive a grade of at least *B* to obtain credit such courses, and in no event will the grade count in computing the cumu- e average.

Master's Candidates.—Master's candidates without substantial outside em- ment may take a maximum of 12 hours a week. Students with more than hours of outside employment must take a limited program of study not to ed 8 hours a week. The minimum load is 4 hours unless approval for er hours is given by the Dean for a limited time.

TENDANCE

ular attendance at classes is required and is necessary for successful work. tudent who is deficient in class attendance in any course may be barred m taking the examination.

ANGES IN PROGRAM OF STUDIES

tudent may not add courses or change from one section to another of the e course without the approval of the Dean. Students may drop courses with the written approval of the Dean. In addition, approval of the in-

structor is ordinarily required unless the request is made early in the semester. Under no circumstances may any student drop a course after the last day of classes in any semester or summer session.

RESEARCH PAPERS

The preparation of a research paper is required in lieu of an examination in seminars and in other courses, as indicated in the course descriptions. To receive a numerical grade on a research paper, the paper must be submitted by the last day of classes in the semester or, with the permission of the instructor, by the last day of the examination period (the last day of any examination given in any course). For sufficient reason, the instructor may extend the deadline (but not later than the last day of the examination period of the following semester) or without express permission of the Dean, not later than the normal graduation date for the student), subject to the following conditions: (1) no student will receive any credit for the course for any purpose until a paper acceptable to the instructor has been submitted; (2) the only grade the student may receive for the course is *CR* (Credit) or *NC* (No Credit). To receive credit, a minimum grade of 65 is required for J.D. candidates, and 75 for LL.M. candidates. Failure ultimately to submit any paper for the course will result in a grade of 45. Students who are candidates for the J.D. degree may register for one course requiring a research paper in each semester; with the approval of the Dean such students may register for more than one such course each semester.

EXAMINATIONS

Written examinations are held at the end of most courses. Every student is required to take the regular examinations unless excused. No excuse for absence will be granted except by the Dean and then only for illness or other emergency. Application for excuse must be made in writing not later than one month after the date of the examination. A student excused from a final examination will be permitted to apply to the instructor for a Credit/No Credit determination. The instructor will select the mode of determination (for example, a make-up examination or paper). The student will have the option of (1) complying (prior to the completion of the semester following the excused absence) with the instructor's procedure of determining Credit/No Credit (minimum grade of 65 required for J.D. candidates, and 75 for LL.M. candidates), or (2) having the grade *I* (Incomplete) entered on the record and taking the next regularly scheduled examination for a numerical grade. The examination may not be taken after exclusion for low scholarship.

Permission to take an examination before the regularly scheduled date will not be granted. Permission to take a postponed examination is limited to the situations provided for in the preceding paragraph.

A student who has been excused from taking a regular examination and who is a candidate for a degree to be conferred prior to the next regular examination in the subject may petition the Scholarship Committee, which may authorize such action as the circumstances require.

If a student fails to take an examination, a grade of 45 will be recorded unless the student has been excused from the examination as provided above or has obtained the Dean's permission to drop the course.

REDIT/NO CREDIT OPTION

ndidates for the degree of Juris Doctor may take, in addition to courses gularly given on a Credit/No Credit basis, 12 semester hours of elective rse work on a Credit/No Credit basis, and will receive a grade of Credit the course is satisfactorily completed with a grade of 65 or better. No stu- nt may change from a numerical grade to a Credit/No Credit basis in a rse during the last four weeks of classes except with the permission of the ructor. An unexcused failure to take an examination in a course or failure ubmit a required research paper will result in the recording of a grade of for a course taken on a Credit/No Credit basis.

No student may take more than 17 semester hours of courses (including Law and other courses regularly given on a Credit/No Credit basis) on a dit/No Credit basis.

Students are advised to consider carefully the advisability of electing to take rses on a Credit/No Credit basis. In the opinion of the faculty, a stu- nt's election to take courses on a Credit/No Credit basis may, in view of importance apparently attached to grades by educational institutions and ployers, be detrimental to the student's career in the legal profession.

RADES

ades are given in numerical terms equivalent to letter grades as follows: 100, *A*, Excellent; 75–84, *B*, Good; 65–74, *C*, Satisfactory; 55–64, *D*, Poor below standard for graduation: 45–54, *F*, Failure. In Law courses 220, 321–323, 342, 343, 345, 346, 385, 399, 459, 479, 509, 579, 593, and 620 grades *CR*, Credit (minimum grade of 65 required for J.D. candidates, 75 re- ed for LL.M. candidates); *NC*, No Credit. In Law 220, the grade of *H* nors) may be earned for work of excellent quality. A student who has been used from taking a regularly scheduled examination is given the grade of *I*, mplete. See "Examinations" (above) for grade upon failure to take an mination. Grades between 55 and 100 indicate that the work has been pleted and credit given. Grades between 55 and 64, however, do not repre- satisfactory work and adversely affect a student's cumulative average. No dit is given to J.D. and M.Comp.L. candidates for grades below 55 or to M. candidates for grades below 65. No grade may be changed by an in- ctor after it has been posted in the law school or disclosed to a student ess there has been an error in arithmetic certified in writing as such by the ructor.

Any student who receives a grade below 55 (*F*) has the right to retake the rse once, from the same or a different instructor, but only within the next demic year. (This does not apply to post-J.D. students.) The grade re- ed in the retaken course shall be entered into the student's record in dition to the original grade, and both grades shall be included in computing student's average. A student may exercise the right to retake a course y with respect to two different courses during study at the Law Center.

The cumulative average of a student includes all grades in all courses taken e a candidate for a particular degree.

EXCLUSION AND PROBATION FOR POOR SCHOLARSHIP

Candidates for the Degree of Juris Doctor.—A student whose cumulative average at the end of any semester falls below 65.0 but is above 64.0 will be put on probation. If such a student fails to raise the cumulative average to 65.0 at the end of the next semester, the student will not be permitted to register for any succeeding semester unless the student petitions for and receives the permission of the Scholarship Committee.

A student whose cumulative average at the end of any semester falls below 64.0 will not be permitted to register for any succeeding semester unless the student petitions for and receives the permission of the Scholarship Committee to register.

A student who fails or receives a grade of No Credit in more than one course over the entire period of law study will not be permitted to register for any succeeding semester or to graduate unless the student petitions for and receives the permission of the Scholarship Committee.

A student who is not permitted to register under the foregoing provisions will be excluded as of the beginning of the semester for which the student was ineligible to register.

Students who are registered at the time they receive notice that they will not be permitted to register for the next semester are entitled to withdraw from school and to receive a full refund of the tuition paid for the semester, or to complete the work for which they are registered.

Any student excluded may petition for reinstatement; if the student can demonstrate that the low grades were due to circumstances beyond the student's control and that the student has the capacity to pursue the study of law with a definite likelihood of success, that student may be readmitted subject to such conditions as may be imposed by the Scholarship Committee.

Despite the above provisions, a student will be allowed to complete the first two semesters of law study before being denied permission to register for a succeeding semester.

For this purpose the term "semester" includes a session of the summer term.

Candidates for Masters' and Doctoral Degrees.—A candidate for a master's or doctoral degree whose work is not satisfactory in the opinion of the faculty, taking into consideration the requirements and standards for the degree, may, by action of the faculty, be excluded at the end of the semester for which the candidate is currently registered.

A cumulative average of 78 (see page 19) is required for the Master of Laws degree and a cumulative average of 65 (see page 25) for the Master of Comparative Law degrees. A student whose cumulative average falls below the required minimum at any time will be ineligible for continuation in the program without the permission of the Dean. Such a student will not be permitted to register for any succeeding semester unless the student petitions for and receives the permission of the Dean or the Board for Graduate Studies.

Unclassified Students.—An unclassified student whose work is not satisfactory may be excluded at the end of the semester for which the student is currently registered.

SUMMER SCHOOL CREDIT

Students planning to attend summer school sessions at other law schools and desiring to use credits obtained at such schools in their Juris Doctor program

this Center must first have the courses they wish to take approved by the Dean. Students may not take courses in summer sessions at other law schools this vicinity if these same courses are being given during the Summer Sessions at the National Law Center. In no event will credit be given for unsatisfactory work or be recognized in excess of that which might be obtained in a similar period in this program. Students who register at another law school must provide the Dean with an official transcript of their work there promptly on its completion.

TRANSCRIPTS OF RECORD

Official transcripts of student records will be issued on request of the student or former student who has a clear financial record. A fee of $2 is charged for each transcript. When more than two transcripts are ordered at the same time, a $2 fee is charged for each of the first two transcripts and a $.50 fee is charged for each additional transcript.

CONTINUOUS ENROLLMENT

Degree candidates are expected to maintain continuous enrollment until *all* degree requirements are satisfied. By failing to register for one semester or more, the student breaks registration and must be readmitted (see "Readmission," page 29). A readmitted student is required to satisfy the curriculum requirements existing at the time of readmission.



GRADUATION REQUIREMENTS

Diplomas are awarded in February, May, and September.

To be recommended by the Faculty for graduation, a student must have met the admission requirements of the National Law Center; completed satisfactorily the scholarship, curriculum, residence, and other requirements for the degree for which the student is registered; and be free from all indebtedness to the University. Registration is required for the semester or summer session at the close of which the degree is to be conferred.

Application for Graduation.—An "Application for Graduation" form must be filed and the appropriate fee paid at the time of registration for the last semester or summer session of the final year. Students completing degree requirements during the Summer Sessions will be awarded diplomas (no formal convocation) September 30, *provided* they have completed all degree requirements and have applied for graduation as a part of registration for the Summer Sessions. If they wish, such students may participate in the Winter Convocation.

ACADEMIC DISHONESTY

The University community, to fulfill its purposes, must establish and maintain guidelines of academic behavior. All members of the community are expected to exhibit honesty and competence in their academic work. Incoming students have a special responsibility to acquaint themselves with, and make use of, all proper procedures for doing research, writing papers, and taking examinations.

Members of the community will be presumed to be familiar with the proper academic procedures and held responsible for applying them. Deliberate failure to act in accordance with such procedures will be considered academic dishonesty. Acts of academic dishonesty are a legal, moral, and intellectual offense against the community and will be prosecuted through the proper university channels.

Copies of the University policy on academic dishonesty can be obtained from the following offices: all department chairmen, all academic deans, and the Vice President for Academic Affairs.

UNIVERSITY POLICY ON THE RELEASE OF STUDENT INFORMATION

The Family Educational Rights and Privacy Act of 1974 applies to institutional policies governing access to and release of student education records maintained by educational institutions which are recipients of federal funds. The University complies with this statute, which states, in part, that such institutions must:

1. afford students access to education records directly related to them;
2. offer students an opportunity for a hearing to challenge such records as inaccurate, misleading, or otherwise inappropriate;
3. receive the student's written consent before releasing information from his or her education records to persons outside the University, except for directory information as indicated below. Information may be furnished to a student's parents without such written consent only upon certification of the student's financial dependency; and
4. comply with a judicial order or lawfully issued subpoena to release a student's record, notifying the student of this action.

The University will release the following directory information upon request: ame, local address, and telephone number; name and address of next of kin; ates of attendance; school, college, or division of enrollment; field of study; redit hours earned; degrees earned; honors received; participation in organ- tions and activities chartered or otherwise established by the University cluding intercollegiate athletics); and height and weight of members of ath- ic teams. A student who does not wish such directory information released st file written notice to this effect in the Office of the Registrar.

Copies of the University's full policy statement on the release of student formation may be obtained from the Office of the Registrar.

GHT TO CHANGE RULES

e University and its various colleges, schools, and divisions reserve the right modify or change requirements, rules, and fees. Such regulations shall go force whenever the proper authorities may determine.

GHT TO DISMISS STUDENTS

a student knowingly makes a false statement or conceals material information an application for admission, registration card, or any other University doc- ent, the student's registration may be canceled and the student will be in- ble (except by special action of the Faculty) for subsequent registration. The right is reserved by the University to dismiss or exclude any student m the University or from any class or classes, whenever, in the interest of student or the University, the University Administration deems it advisable.

GHT TO MAKE CHANGES IN PROGRAMS

e right is reserved by the University to make changes in programs without ice whenever circumstances warrant such changes.

OPERTY RESPONSIBILITY

e University is not responsible for the loss of personal property. A "Lost d Found" Office is maintained on campus in the Safety and Security Office.

UDENT CONDUCT

students upon enrolling and while attending The George Washington Uni- ity are subject to the provisions of the *Statement of Student Rights and sponsibilities* which outlines student freedoms and responsibilities of conduct, Judicial System for Non-Academic Student Discipline, and other policies regulations as adopted and promulgated by appropriate University authori- Copies of these documents may be obtained at the Office of the Vice Presi- for Student Affairs. Sanctions for violation of these regulations may in- de permanent expulsion from the University, which may make enrollment in ther college or university difficult. Regulations or requirements applicable to a particular program, facility, or class of students may not be published erally, but such regulations or requirements shall be published in a manner sonably calculated to inform affected students.

IVERSITY POLICY ON DRUGS

e University cannot condone violations of law, including violation of those which proscribe possession, use, sale, or distribution of drugs. Members of

the academic community should know that administrative action, which may include dismissal from the residence halls, revocation of other privileges, or suspension or dismissal from the University, may be taken in order to protect the interests of the University and the rights of others.

Center for Academic and Administrative Computing

Director F. William Rambo

The Center for Academic and Administrative Computing is located on the third floor of Lisner Hall, 2023 G St., N.W. The computer and other operational supportive services are located on the first floor of Stuart Hall, 2013 G St., N.W. These facilities normally are available 24 hours a day, seven days a week to all faculty, staff, and students.

The Center provides computational facilities, conducts seminars, consults with users, and provides operational assistance as required. The Center operates an IBM (OS/VS1) central processing unit and a PDP 11 mini-computer which provides a terminal-based text-editing system for students. There is a full range of compilers and application software packages.

Computer programming courses are offered by the School of Government and Business Administration, the Department of Statistics, and the School of Engineering and Applied Science. In addition, many other departments offer courses that utilize the computer as a research adjunct to course work.

Any student of the University may have access to the computer for class-related or individual research. Access is by request and without charge.

Student Services

RESIDENCE HALLS

The University does not provide regular residence hall space for graduate students. However, the Housing Office refers graduate students to apartments as they become available in a University-owned building which is in the campus area. Additionally, the Housing Office operates an Off-Campus Housing Resource Center, and attempts to provide information and assistance for those seeking accommodations. For complete information on this service, as well as apartment guides and referrals, interested applicants should contact Director of Housing, George Washington University, Washington, D.C. 20052.

FOOD SERVICE

Contract food service is available from August to May, and is based on the undergraduate academic calendar of registration, exams, and vacation periods. Accommodations for the law school calendar are made. The rate for the seven-day, 19 meals per week plan has been set at $1,546. The any 14 meals per week plan costs $1,480, the any 10 meals per week plan, $1,426. Contract service is cafeteria style and provided in two residence halls and the Cloyd Heck Marvin Center. Meal coupons may also be used on a cash equivalency basis in the Marvin Center first floor a la carte cafeteria and in the Rathskeller.

LOYD HECK MARVIN CENTER

he Cloyd Heck Marvin Center serves as the campus community center, pro-ding services, conveniences, and recreational and social opportunities for dents, faculty, staff, alumni, and guests. Its wide range of facilities pro-des the setting for a variety of programs conducted by the University Pro-am Board, the departments offering course work in the performing arts, and her student and faculty organizations.

The Center Governing Board, representing varied segments of the University mmunity, plays an important role in the day-to-day functioning of the Cen-. This Board works closely with the full-time staff in the development of ocedures and policies which provide a framework for the Center's operation.

UDENT HEALTH SERVICE

e Student Health Service is an outpatient clinic located in the H.B. Burns morial Building at 935 22nd St., N.W.

The Health Service is staffed by physicians, nurse practitioners, and physi-n's assistants who are capable of addressing most of students' medical prob-. Visits are cost-free and may be either arranged by appointment or, ng certain hours, secured on a walk-in basis. Most routine laboratory tests be performed in the Health Service lab at cost, many common medica-s are stocked to fill students' prescriptions, and allergy shots and immuniza-s are administered by the staff nurse for a minimal charge. A psychiatrist s in the Health Service to assist students with mental health concerns.

For serious emergencies occurring during hours when the Student Health fice is closed, students may go to the Emergency Room of the University spital for treatment. This arrangement is for emergency care only, and all re the responsibility of the student.

udents must be currently enrolled on campus in the University to receive tment at the Student Health Service. Students enrolled in off-campus pro-s and the Continuing Engineering Education Program are not eligible. ents who so desire may engage physicians and nurses of their own choice, hese students will be responsible for all fees charged. The bills incurred all services rendered outside of the Student Health Service (for example, x work, laboratory work, and referrals to specialists or other outside physi-ns) are the responsibility of the student.

lth and Accident Insurance

e University has arranged for and endorsed group health and accident in-rance, on an elective basis, for those students who do not have other cover-. Interested students should contact the Student Health Service or Office of Dean of Students.

UDENT EMPLOYMENT

tudent taking more than 10 semester hours must limit outside employ-nt to not more than 20 hours (see "Academic Work Load," page 37). It is ed that full-time students refrain from engaging in outside employment ring their first year. Although work in some special areas may contribute e learning and experience of the student, as a general rule it will compete ome needed for adequate study and preparation, which are at the heart of d legal education.

PLACEMENT SERVICE

The Law Center takes a continuing interest in the placement of its students and alumni. The Dean, the Faculty, and the Placement Office cooperate in providing information from alumni, law firms, government agencies, and other sources concerning job openings for our seniors and alumni throughout the country. Other services include part-time and full-time law clerk listings, summer positions, programs on job-seeking skills, a library of available literature on law placement, counseling on various opportunities, resume preparation guidance, arrangement of on-campus interviewing programs, and the administration of the judicial clerkship evaluation program.

Two hundred eighty members of the 1981 graduating class informed the Placement Office of their positions. There was considerable variety in the types of positions obtained, with 165 in private law firms, 40 with government agencies, 31 with corporations, 25 as judicial law clerks, five with public interest organizations, six in military (JAG) positions, and six in academic positions. These positions were located in 34 states and the District of Columbia.

VETERANS BENEFITS

The veterans counselor, located on the fifth floor of Rice Hall, 2121 Eye Street, N.W., assists students entitled to educational benefits as veterans or as widows or children of deceased or totally disabled veterans with any problems which may arise concerning their benefits. This Office also processes certification of enrollment and attendance to the Veterans Administration so that monthly allowances will be paid.

When feasible, students entitled to benefits as veterans or dependents of veterans should consult with the veterans counselor prior to submitting application to the Veterans Administration. All such students should obtain the instruction sheet issued by the Office of the Registrar, which sets forth requirements to be fulfilled before certification of enrollment can be made to the Veterans Administration, and which includes other information of general interest.

The Veterans Administration is at 941 N. Capitol St., N.E., Washington, D.C. 20421.

OFFICE OF SERVICES FOR STUDENTS WITH DISABILITIES

The Director of the Office of Services for Students with Disabilities coordinates advising, orientation, and special services which address the needs of disabled students. The Director also serves as a central point of contact from which the University community may obtain information and assistance in serving disabled students. A resource library maintained in the Services Office is available for general use.

In addition to coordinating a program of general assistance to promote integration of disabled students as fully as possible into the life of the University community, the Director administers reading and sign language services for those with visual and auditory handicaps.

The Office of Services for Students with Disabilities is located on the fourth floor of Rice Hall, 2121 Eye Street, N.W.

COURSES OF INSTRUCTION

Courses for Juris Doctor Candidates

Career Planning and Course Selection

One of the great strengths of the National Law Center is the diversity of its course offerings and the flexibility it offers students to design their programs to fit their interests and career plans. Every spring a series of counseling sessions is held to provide students with an overview of course offerings in various areas of the law and to assist them in selecting courses and defining their career objectives. Students also may consult members of the faculty and the Associate Dean for Student Relations for course and career planning. In addition, the Placement Office provides a central storehouse of information regarding many types of legal careers.

The Law Center's broad offering of elective courses is listed below. Courses numbered 400 and above are generally more advanced, but are open to second- and third-year students who have taken the prerequisite courses. Both second- and third-year students may take more than one such course with the permission of the Dean.

Among the courses offering clinical work are: Law 343, 345, 346, 396, 398, 399, 459, 516, 579, and 596.

The courses of instruction listed below are subject to change. The University reserves the right to withdraw any course announced.

Elective Courses (Numbered 301–400)

Administrative Law (372)
Advanced Criminal Procedure (334)
Agency and Partnerships (311)
Collective Bargaining and Labor Arbitration (339)
Commercial Paper (314)
Community Legal Clinic (346)
(1) Civil Administrative Law Clinic
(2) Immigration Clinic
(3) Outside Clinical Placement
(4) Small Business Clinic
(5) Institute of Law and Aging
Comparative Law (307)
Conflicts (309)
Corporations (312)
Creditors' Rights (318)
Current Decisions (321)
Disabled People and the Law (397)
Domestic Relations (348)
Federal Antitrust Law (330)
Federal Indian Law (391)
Federal Jurisdiction (332)
Government Contracts (355)
Insurance (347)
International Law and World Order (303)
Journal of International Law (323)
Jurisprudence (335)
Labor Law (341)
Law and Accounting (351)
Law and Medicine (390)
Law and the Deaf (398)
Law Students in Court (345)
Law Students Civil Rights Research Council (343)
Legal Activism (396)
Legal Process (315)
Legal Writing (344)
Medicine for Lawyers (389)
Modern Real Estate Transactions (327)
Moot Court (342)
Patent Law (359)
Patent Office Practice (362)
Remedies (375)
Sales and Sales Finance (313)
Tax—Corporations and Shareholders (340)
Tax—Federal Estate and Gift (338)

Tax—Federal Income (336)
Trial Practice Court (385)
Trusts and Estates (I) (II) (325) (326)
Unfair Trade (329)
United Nations Law and World Order (304)
Women and the Law (394)

Advanced Courses and Seminars (Numbered 401–600)

Administrative Practices and Procedures (FDA) (411)
Advanced Topics in Patent Law (527)
American Legislative History (593)
Business Planning (424)
Chemical Patent Practice (524)
Chinese Law (547)
Clinical Studies in Environmental Law (516)
Clinical Studies in Urban Law (579)
Community Property Law (569)
Comparative Labor Law (440)
Computers and the Law (585)
Copyright Law (525)
Crime Lab (473)
Criminal Practice (479)
Drugs and the Law (481)
Energy (512)
Environmental Law I (508)
Environmental Litigation (513)
Equal Employment (446)
Equal Employment Claims and Litigation (450)
Estate Planning (553)
Food and Drug Law (412)
Government Contracts (435)
Government Procurement Law (431)
Graduate Clinical Studies (596)
Health Care Delivery Systems (408)
Immigration Law (586)
Independent Studies (597)
Individual Rights (587)
Intergovernmental Relations I (505)
International Economic Law (426)
International Law of Air and Space (531)
International Law of Human Rights (537)
International Law of the Sea (532)
Labor Law (447)
Labor Litigation (448)
Labor Relations (443)
Labor Standards (442)
Land Development Law (501)
Land Development Planning (503)
Law and Criminology I, II (475, 476)
Law and Psychiatry (486)
Law of Criminal Corrections (480)
Legal Aspects of International Business Transactions (427)
Legal Research, Writing—Foreign Students (620)
Legislative Drafting (591)
Natural Resources Law (514)
Negotiations (535)
NLRB Procedures (445)
Occupational Safety and Health (OSHA) (451)
Patent and Know-How Licensing (522)
Performance of Government Contracts (432)
Pollution Control Law (515)
Problems of the Consumer Clinic (459)
(1) Consumer H-E-L-P
(2) Bankruptcy Clinic
(3) "Contact 4" (Television Consumer Service)
(4) Consumer Protection Reporting Service
(5) Institute of Law and Aging
Professional Responsibility (594)
Public Economic Policy and the Law (403)
Public Policy and Mass Media (413)
Public Sector Labor Law (452)
Regulation of Securities Markets (405)
Research in Public Law (598)
Securities Regulation (404)
Soviet Law (546)
Taxation—Deferred Compensation I, II (565, 566)
Taxation—Oil and Gas (559)
Taxation—Partnerships and Subcharter S (551)
Taxation—Real Estate and Income (558)
Taxation—Special Corporation Problems (555)
Taxation—State and Local (560)
Tax-Exempt Organizations (557)
Tax Practice (567)
Thesis (599, 600)
Trade Regulation (417)
U.S. Regulation of International Trade (542)
Use and Control of Nuclear Energy (518)
Water Resources (510)

ourses Not Offered 1982–1983

dmiralty (302)
mmunity Economic
Development (575)
nstitutional Law Seminar (592)
ontrol of Toxic and Hazardous
Substances (517)
ourt Review of Patent Office
Decisions (523)
riminal Tax Prosecution (552)
urrent Problems in Civil Rights (460)
urrent Problems in Land Use
Controls (504)
plomatic and Consular Law and
Practice (536)
nvironmental Law II (509)
nvironmental Planning (511)
raud in Patent Practice (363)
ome Taxation of Foreign
Business and Investment (562)
ntergovernmental Relations II (506)
International Humanitarian Law of
Coercion Control (533)
Juvenile Justice (487)
Law and Economic Development (407)
Law of the Near East (548)
Law of Privacy (589)
Legal Problems in Education (588)
Legislation (366)
Patent Interference Practice (528)
Police and the Community (477)
Practical Economics for Lawyers (415)
Product Liability (331)
Regulated Industries (414)
Regulation of Securities Trading (406)
Research in Patent, Trademark, and
Copyright Law (529)
Special Problems of Tax Policy (564)
U.S. Trademark Law (526)
U.S. Foreign Relations Law (534)

OURSE DESCRIPTIONS

he courses of instruction are described below. The number of hours of credit ven for the satisfactory completion of a course is indicated in parentheses er the name of the course. Thus, a year course giving two hours of credit ch semester is marked (2–2), and a semester course giving two hours of credit marked (2).

In most courses, a final examination is held during the examination period, d the grade in the course is determined in large part by that examination. ese courses are parenthetically marked "Examination."

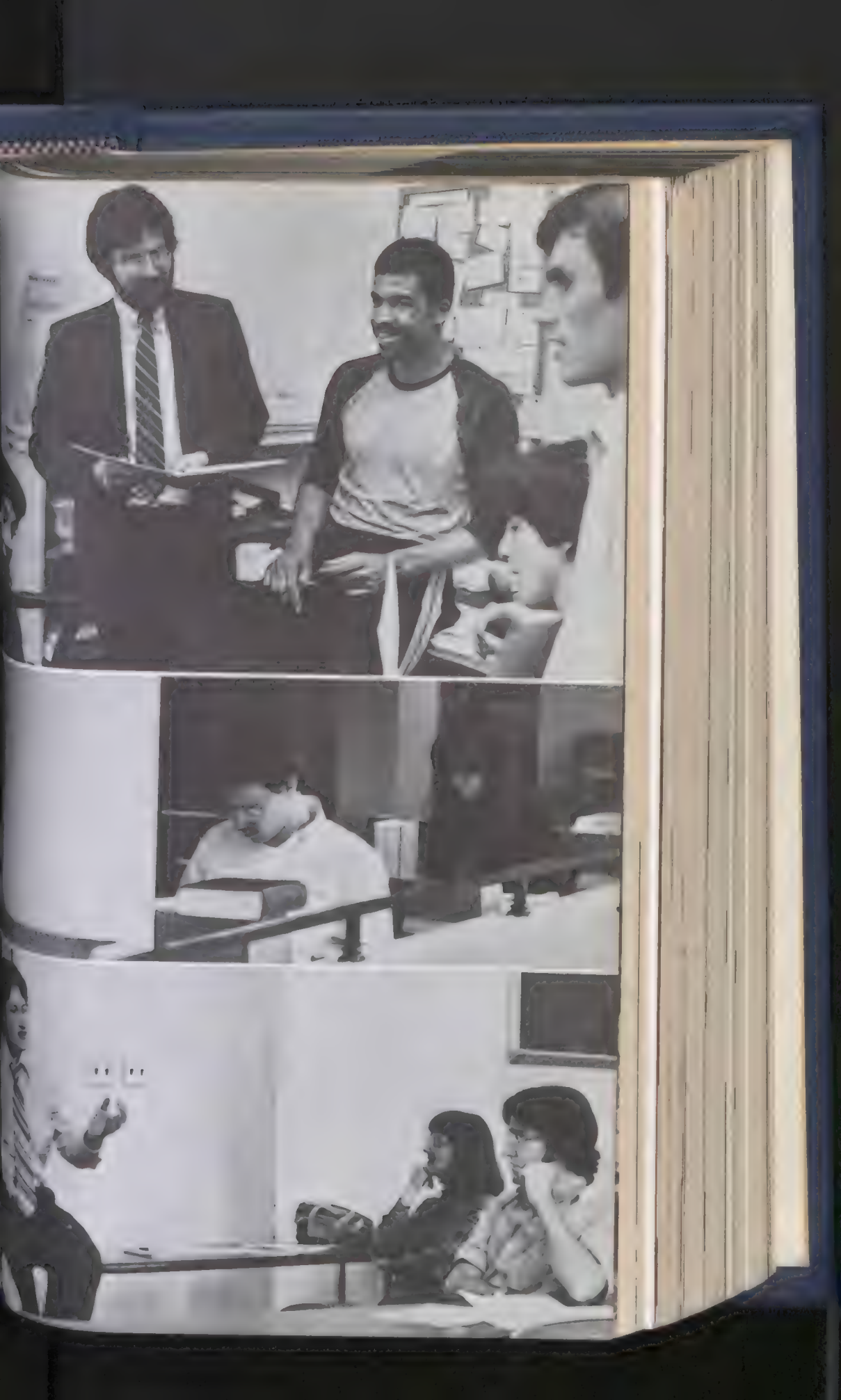
Courses that require the preparation of a major research paper in lieu of an amination are parenthetically marked "Research Paper." The satisfactory mpletion of such a paper by a student individually will satisfy the Legal iting curriculum requirement for the J.D. degree.

Courses parenthetically marked "Problem Assignments," "Writing Assignents," "Take-home Examination," "Choice of Paper or Examination," or Clinical Work" indicate the nature of the method planned by the instructor determining in major part the grade to be given for the course. Only Reearch Papers qualify for the Legal Writing curriculum requirement for the D. degree.

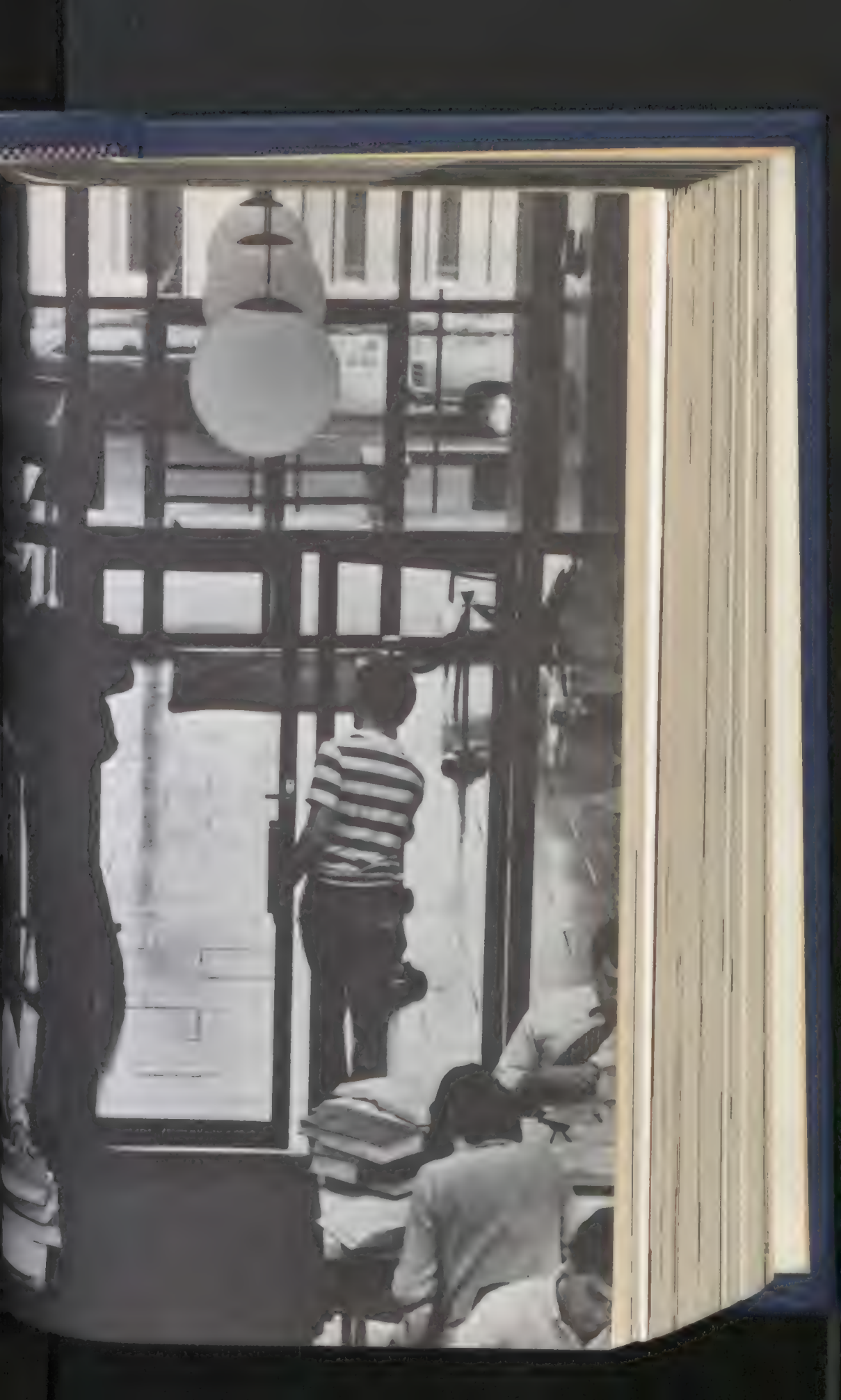
Day classes begin at 9:10 a.m. and run throughout the entire morning and ternoon. Evening classes begin at 5:50 p.m. Many examinations for both y and evening classes may be given in the afternoon only. Examinations for y students may be held in the evening.

A parenthetical designation at the end of a course description indicates ether the course is scheduled to be offered in the spring or fall semester or the summer sessions, and also usually whether it will meet in the day or ening. When a double-numbered course is designated "Academic year," the t half of the course is scheduled to be offered in the fall, the second half the spring.









REQUIRED COURSES

203–4 **Contracts I–II** (4–2) Nash, Cibinic, Pock, Caplan
Legal remedies of contracting parties, including damages in contract and quasi-contract, specific performance, reformation, rescission, remedies in tort; acts creating and terminating contractual rights, including offer and acceptance, mistake, problems of proof; function of consideration; conditions; assignments; third-party beneficiaries; effect of changed circumstances; protection of the client's interests upon breach or threat of breach by the other party. Emphasis on problems of analysis, draftsmanship, adversary method. (Examination) (Academic year—day and evening)

207 **Torts** (4) Seidelson, Banzhaf, Schwartz, Sirulnik, Reitze, Dienes
Liability for harm to person or property. Intentional torts, negligence, nuisance, products liability, misrepresentation, defamation, and invasion of privacy; fault and other basis for shifting losses; causation; damages; effects of liability insurance; problems under Federal Tort Claims Act (Examination) (Fall—day and evening)

211 **Property** (4) Starrs, Schiller, Brown, Chandler, Holt
Basic concepts of personal property. Real property: historical background of the law of estates and conveyancing, types of estates, dower and curtesy, landlord and tenant relationship, concurrent estates, future interests at common law and after the Statute of Uses; introduction to modern conveyancing—the real estate contract, the deed, the recording system, methods of title assurance. (Examination) (Fall—evening; spring—day; summer 1982)

212 **Constitutional Law** (4) Mayo, Barron, Park, Cheh, Dienes
Basic principles of American constitutionalism; judicial function in constitutional cases; implementation of doctrines of separation of powers, federalism, limited government; development and exercise of national powers; introduction to civil rights and liberties. (Examination) (Spring—day and evening)

215 **Criminal Law and Procedure** (4) Starrs, Robinson, Zenoff, Sirulnik, Caplan
Purposes of criminal law, elements of criminal liability, selective consideration of specific crimes, introduction to criminal procedure. (Examination) (Fall—day; spring—evening)

218 **Civil Procedure** (4) Sharpe, Barron, Schwartz, Kayton, Stevenson, Cheh, Raven-Hansen, Reitze, Shreve, Trangsrud
Mechanics of litigation—rules which govern the process by which rights and duties studied in substantive law courses are enforced; pleadings, discovery, pre- and post-trial motions, jurisdiction and venue, equity jurisdiction and trial by jury, former adjudication. Emphasis on Federal Rules of Civil Procedure, but principles and main problems indigenous to all procedural systems are developed. (Examination) (Spring—day and evening)

220 **Legal Research, Writing, and Professional Responsibility and Ethics** (2) Cheh and Staff
Introduction to and practical experience in the use of a law library; instruction and practice in legal writing, including a memorandum and appellate court brief; instruction and experience in the preparation and argument of an appellate court case; instruction in questions of professional responsibility and ethics. The grade *H* (Honors), *CR* (Credit), or *NC* (No Credit) is given for this course. For Honors, a student must do work of excellent quality. For credit, a student must attain a minimum grade of 65. Failure to complete the work in this course will result in a grade of 45. (Fall—day and evening)

232 **Evidence** (4) Seidelson, Robinson, Albert, Park, Schechter
Preparation and presentation of evidence, including proof of writings; qualification and examination of witnesses with emphasis on impeachment; privilege; opinion testimony; determination of relevancy; demonstrative, experimental, scientific evidence; application of the hearsay rule. (Examination) (Spring—day and evening)

ELECTIVE COURSES

302 **Admiralty** (3) Sharpe
American practice and jurisdiction in admiralty; saving clause actions at law. Substantive maritime law of title and possession, maritime liens, personal injury and wrongful death, charter parties and bills of lading, general average and salvage and marine insurance, collisions. Lawmaking methods: judge-made law, statutes, international commercial custom, and treaties. (Examination)

303 **International Law and World Order** (3) Mallison
An introduction to international law which provides the background for the study of specialized seminars; emphasis on national states as participants in decision-making processes with consideration of public bodies and other participants; analysis of range of available sanctions; roles and effects of international agreements under United States Constitution; introductory study of the World Bank. Complements but does not repeat material in Law 304. (Examination) (Fall—day and evening; summer 1982)

304 **United Nations Law and World Order** (2) Mallison
Introduction to international law through study of law and practice of United Nations Charter; structure and process of decision of United Nations; maintenance of international peace and security—peaceful settlement of disputes and national and collective self-defense; including current problems considered by the General Assembly and Security Council and recent decisions of the International Court of Justice. Complements but does not repeat the material in Law 303. (Examination) (Spring—evening)

307 **Comparative Law** (3)
Introduction to comparative method and analysis, basic features of civil law systems, sources, legal profession, judicial organization, constitutional issues. The course includes material dealing with selected issues of contemporary and practical interest in such fields as domestic relations, inheritance, contracts, torts, consumer protection. Emphasis on the intimate relationship between comparative law and conflict of laws, and description of methods of conflict avoidance and problems attendant upon transnational litigation. (Examination) (Spring—day)

309 **Conflicts of Laws** (3) Seidelson, Pock, Lowther
Legal problems arising from occurrences transcending state or national boundaries; jurisdiction; foreign judgments; constitutional influences; theoretical bases of choice of law principles and their application to specific fields, including torts, contracts, property, family law, administration of estates, business associations. The grade *CR* (Credit) or *NC* (No Credit) only is given in sections taught by Lowther. Lowther—(Problem Assignments); Seidelson, Pock—(Examination) (Fall—evening; spring—day and evening)

311 **Agency and Partnerships** (2) Sharpe, Schiller, Jaffe
Employment relations, vicarious liability of employers for employees' torts, scope of employment, and independent contractors; agents' authority

and apparent authority to contract for their principals, ratification; nonprofit associations; the formation, operation, and termination of partnerships; limited partnerships. (Examination) (Spring—day and evening. summer 1982)

312 **Corporations** (4) Stevenson, Solomon, Park, Cheh, Steinberg
Corporate law, with emphasis on operations and financing of corporations. Control of corporations, action by corporate directors, officers, shareholders. Control devices. Directors' and shareholders' duties of care and loyalty, insiders' transactions in shares of the corporation. Derivative suits, kinds of shares, dividends, corporate distributions. (Examination) (Fall—day and evening)

313 **Sales and Sales Financing** (2) Albert, Rothschild, Zubrow
Provisions of the Uniform Commercial Code relating to sale and distribution of goods, including bulk transfers, warehouse receipts, bills of lading, and other documents of title; particular attention to secured transactions and financing devices utilized in this connection. (Examination) (Fall—day and evening; spring—day)

314 **Commercial Paper, Check Collection, and Banking** (2) Albert, Rothschild, Zubrow
Classic view of negotiable instruments as codified by Article III of the Uniform Commercial Code. Check collection: the system in theory as expressed in Article IV of the Uniform Commercial Code and the system in practice; Federal Reserve regulations, Clearing House agreements, and automation systems. The dual banking system, work of the Comptroller General and the Federal Reserve Board. Legal problems concerning interest and the checkless society. (Examination) (Fall—day; spring—day and evening)

315 **The Legal Process** (3) Robinson, Levine
American legal institutions and their interrelationships and processes. Jurisprudential concepts in the context of specific problems commonly faced by private and governmental lawyers, legislators, courts, and administrative agencies. Issues of statutory interpretation, the roles of courts in making new law, and the allocation of functions between courts, administrative agencies, legislatures, and private decision-makers. (Examination) (Fall—day)

318 **Creditors' Rights** (3) Cheh, Zubrow
Creditors' remedies and debtors' protections under state law: writs of attachment, garnishment and execution, acquisition of liens and forced sales of property, self-help arrangements, and security agreements. Bankruptcy under federal law: who may file, the creation and administration of the bankruptcy estate, powers of the trustee, discharge of debt; rehabilitation plans for individuals under Chapter 13. (Examination) (Fall—evening; spring—day)

321–22 **Current Decisions** (1 or 2 per semester)
Limited to members of the student staff of the *Law Review*. A maximum of 4 semester hours of credit may be earned in this course. The grade *CR* (Credit) or *NC* (No Credit) is given for this course. (Academic year—day and evening)

323 **Journal of International Law** (1 to 4)
Limited to editors of the student staff of the *Journal of International Law and Economics*. The grade *CR* (Credit) or *NC* (No Credit) is given for this course. (Fall and spring—as arranged)

325–26 **Trusts and Estates I–II** (3) Weaver, Chandler, Solomon, Sims, Holl
Noncommercial transfers of wealth at death or during life. Law 325: essential elements and formalities for creation of trusts and execution of

wills, revocation and alteration, grounds for contest, limits on property owner's power to control, intestate succession. Law 326: dispositive provisions, common questions of construction, future interests problems, administration of estates and trusts, charitable trusts. Prerequisite to Law 325: Law 211; to Law 326: Law 325. (Examination and Problem Assignments) **(Law 325: fall—day and evening; spring—day; Law 326: fall—day; spring—evening)**

327 **Modern Real Estate Transactions** (2) Brown, Schiller

Advanced problems in purchase and sale of real estate: legal responsibility and functions of buyer, seller, broker, escrow agent, conveyancing attorney, title examiner, abstractor, insuror of title; process of examination and assurance of title and other interests in realty, including recording, registration and title insurance systems, settlements and closings, warranties, hazard insurance; emerging problems related to cooperatives, condominiums and property-owners' associations; problems related to compliance with subdivision, zoning, building and housing code regulations. (Examination) **(Spring—day)**

329 **Unfair Trade Practices** (3) Weston, Banzhaf, Schwartz, Schechter, Tasker

Unfair trade practices at common law and under statutes; trademarks, trade names; copyright law; misappropriation of ideas; protection of competitors and consumers against false advertising under Federal Trade Commission Act; resale price maintenance under state Fair Trade Acts; state sales-below-cost statutes; Robinson-Patman Price Discrimination Act; miscellaneous business practices. (Examination) (Fall—day and evening)

330 **Federal Antitrust Laws** (3) Weston, Schechter

Sherman and Clayton Acts, related statutes. Price-fixing agreements and other types of trade restraints considered under Section 1; monopolizing considered under Section 2 of the Sherman Act. Mergers and tie-in sales; other activities under the Clayton Act. All types of business conduct raising questions under the antitrust laws, including trade association activities, exclusive-dealing arrangements, boycotts, patents and copyrights. (Examination) **(Fall—day; spring—evening)**

331 **Product Liability** (2) Schwartz

Development of the concept of product liability and consumer's remedies. Specific problems and processes in evaluation of risk and benefit encountered in government regulation of dangerous and defective products. Survey of civil actions for harm resulting from defective and dangerous products with reference to parties and proof in negligence, warranty, nuisance, fraud, misrepresentation, and other cases. Problems associated with hazard identification, insurance, and industry self-regulation. Review of Consumer Product Safety Act and current legislation dealing with injuries and remedies in specific areas. (Choice of Research Paper or Examination)

332 **Federal Jurisdiction** (2) Albert, Lowther, Barron, Kayton, Raven-Hansen, Shreve, Holt, Trangsrud

Relationship of federal courts to Congress and to the states, through analysis of cases dealing with federal judicial functions (including problems of advisory opinions, standing to litigate, justiciability), federal questions in federal courts, federal review of state court decisions (including relation between state and federal substantive law, procedural problems in exercising review, application of law to fact). The grade *CR* (Credit) or *NC* (No Credit) only is given in sections taught by Lowther. Albert—(Examination); Lowther—(Problem Assignments) **(Fall and spring—day and evening)**

334 **Advanced Criminal Procedure** (2) Starrs, Robinson, Zenoff
Decision to arrest, prosecutive discretion, bail, the preliminary hearing, right to a speedy trial, discovery, plea bargaining, publicity, post-conviction procedures. Starrs—(Examination and Problem Assignments); Robinson, Zenoff—(Examination) (Fall—day and evening; summer 1982)

335 **Jurisprudence** (2) Mayo, Park, Albert, Chandler
Basic jurisprudential concepts; nature of law; development of legal institutions; jurisprudential schools—natural law, analytical, historical, sociological, functional; law and logic; law and justice; the judicial process; legislative, executive, administrative decision-making; impact of politics, economics, and scientific advance on legal systems; contemporary trends in jurisprudential thought. Mayo, Park, Albert—(Examination); Chandler—(Research Paper) (Fall—day and evening; spring—day)

336 **Taxation—Federal Income** (3) Weaver, Hambrick, Solomon, Kempler, Sims
Survey of substantive provisions of federal income tax law, including concept of gross income, provisions affecting taxation of family and individual transactions, limitations on allowable deductions, sales and dispositions of property, problems of capital gains taxation, nontaxable exchanges. Weaver—(Examination and Problem Assignments); Hambrick—(Examination) (Fall and spring—day and evening)

338 **Taxation—Federal Estate and Gift** (2 or 3) Hambrick, Weaver
Survey of substantive provisions of federal estate and gift tax laws, including inter vivos transfers, transfers in contemplation of death, joint interests, life insurance proceeds, property subject to powers of appointment, marital deduction and split gifts; tax procedure. (Examination) (Fall—evening)

339 **Collective Bargaining and Labor Arbitration** (3) Merrifield, Rothschild, Seibel, Jaffe
Collective labor agreement: content, negotiation, administration through grievance procedure and arbitration; problems in settlement of labor disputes. Prerequisite: Law 341. Merrifield—(Examination and Problem Assignments); Rothschild and Jaffe—(Problem Assignments) (Spring—day and evening; summer 1982)

340 **Taxation—Federal Income, Corporations and Shareholders** (3) Hambrick, Solomon, Kempler, Sims
Continuation of Law 336. Primary emphasis on corporate-shareholder relationships. Problems of corporate dividends, redemptions of stock, distributions in partial and complete liquidation, stock dividends, bail-outs, and dividends in kind closely analyzed. Federal income tax problems involved in the formation of corporations, the sale of corporate businesses (including collapsible corporations), mergers and acquisitions, and corporate divisions. Students who have received credit for former Law 33[illegible] cannot receive credit for Law 340. Prerequisite: Law 336. (Examination) (Fall and spring—evening)

341 **Labor Law** (3) Merrifield, Albert, Rothschild, Jaffe
Law governing labor-management relations, organizations and representation of employees, regulation of economic weapons, enforcement of collective bargaining agreements, interunion and intra-union relations. (Examination) (Fall—day and evening)

342 **Moot Court** (1 or 2)
Satisfactory participation in the upperclass competition results in one hour of academic credit. Finalists in the upperclass competition receive two hours of academic credit. Finalists in the first-year competition receive one hour of academic credit. No academic credit is awarded to

nonfinalists in the first-year competition. The grade *CR* (Credit) or *NC* (No Credit) is given for this course. (Fall and spring)

343 **Law Students Civil Rights Research Council (LSCRRC)** (2, 3, or 4) Sirulnik and Staff

Clinical problems concerned with the legal problems of minorities, women, and the poor. Students work with organizations such as the Lawyers Committee for Civil Rights Under Law, Women's Legal Defense Fund, Civil Rights Division of the Justice Department, Institute for the Development of Indian Law, National Committee Against Discrimination in Housing, and National Senior Citizens Law Center. Approximately 60 hours of work per semester is required for each credit hour. The grade *CR* (Credit) or *NC* (No Credit) is given for this course. Permission of the instructor is required prior to registration. (Fall, spring, summer)

344 **Legal Writing** (1 or 2) Staff

Preparation of a research paper under the supervision of a full-time member of the Faculty who will determine, prior to registration, whether the work required for the topic selected justifies one or two semester hours of credit. If elected for one hour of credit, this course may be repeated to meet the legal writing requirement for the degree. Approval of the faculty member is required prior to registration. (Research Paper) (Fall and spring—as arranged; summer)

345 **Law Students in Court** (4) Bright

A clinical program in trial advocacy, offering an opportunity to develop skills as a trial lawyer while representing indigent persons in the Superior Court of the District of Columbia. Students may participate in either the civil division (which focuses primarily upon the representation of tenants in landlord-tenant actions, but also handles some consumer, negligence, and other civil matters) or the criminal division (in which student litigators defend persons charged with misdemeanor offenses). Students in both divisions have the opportunity for jury trials. They are responsible for all aspects of litigation under the supervision of clinical instructors: interviewing clients and witnesses, conducting investigations, preparing pleadings, engaging in settlement negotiations or plea bargaining, and conducting all motions hearings and trials pursuant to the Superior Court's third-year practice rule. Only third-year students who have completed Law 218, 215, and 232 may participate in the clinic. Seminars are held in the civil division on Monday evenings, and in the criminal division on Wednesday evenings. Students must have one day per week available for court appearances and plan to devote approximately 20 hours per week to the clinic. Students must participate in the program for two consecutive semesters, beginning in either the summer or fall. Application must be made during the spring semester of the preceding academic year. This course may not be taken at the same time as Law 579, or any litigating activities in Law 346. Enrollment is limited, with selection by lottery. The grade *CR* (Credit) or *NC* (No Credit) is given for this course. (Fall, spring, and summer)

346 **Legal Aid** (arr.) Sirulnik and Staff

(1) *Civil Administrative Law Clinic*—Working under the supervision of staff attorneys, students represent indigent litigants before state and federal administrative agencies. Activities include Social Security Disability hearings, Rental Accommodations Office hearings, Unemployment and Workman's Compensation hearings, Food Stamp reviews, will writing, and other public benefits program work. Ten hours work per week required. Two-hour weekly seminar and additional weekly meeting with supervisor. Permission of the instructor required prior to registration.

(2) *Immigration Clinic*—Clinical work includes representation of clients at deportation hearings, and oral argument before the Immigration and Naturalization Service, Board of Immigration Appeals, and the U.S. Court of Appeals. Students will assist aliens residing in the Washington area with a wide variety of problems, including adjustment from nonimmigrant to immigrant status, obtaining labor certifications and work visas, obtaining visas for their relatives in other countries to enter the United States, and obtaining voluntary departure orders for those whose visas have expired and who are threatened with deportation. Ten hours work per week required. Two-hour weekly seminar and additional weekly meeting with supervisor. Permission of the instructor required prior to registration. Successful completion of Law 586 suggested but not mandatory.

(3) *Outside Clinical Placement*—Students arrange independent projects with state or federal public interest organizations for academic credit. A compilation of suggested projects available within the Community Legal Clinics office. Projects must receive prior approval by the Director of Clinical Programs or the staff.

(4) *Small Business Clinic*—Under guidance of the instructor, students assist small businesses and non-profit organizations, dealing with a wide variety of problems, including drafting partnership and incorporation papers, drafting and reviewing contracts and commercial leases, advising on tax problems, and resolving disputes. Prerequisite: Law 312 and 336. Permission of the instructor required prior to registration.

The grade *CR* (Credit) or *NC* (No Credit) is given for all sections of this course. (Fall, spring, summer)

347 **Insurance** (2) Schiller, Pock, Albert
A primary risk-distributing medium and the rules by which legislative, administrative, and judicial bodies seek to promote its benefits and avert its dangers. Includes insurance marketing, insurable interest, subrogation, transfer of insurance benefits to nonpolicyholders, coverage and other insurance policy provisions, disposition of claims. (Examination) (Fall—evening; spring—day; summer 1982)

348 **Domestic Relations** (2) Potts, Zenoff
Marriage, annulment, and divorce; adoption and custody of children; economic relations. (Examination) (Fall—evening; spring—day)

351 **Law and Accounting** (2) Cibinic, Kempler, Taubman
Study of fundamental accounting principles with emphasis on corporation accounting; legal and accounting implications of specific items in financial statements of corporations; inventory adjustments; corporate transactions, distributions, capital adjustments. Strongly recommended for students who have had no accounting. (Examination and Problem Assignments) (Fall—evening; spring—day)

355 **Government Contracts** (3) Nash, Cibinic
Survey of basic law underlying government procurement, basic power and limitations on federal government in entering into contracts, administrative and legislative policies governing these contracts, advertised and negotiated procurement procedures, forms of contracts and clauses used. Law 431 *Government Procurement Law* is the substantial equivalent of this course. (Examination and Problem Assignments) (Spring—day)

359 **Patent Law** (2) Kayton
Law of patents subsequent to issuance of patent; nature of patent as property and as a legal instrument; validity—novelty, nonobviousness, utility and enablement; infringement, doctrine of equivalents, and file-wrapper estoppel. Substantive concepts introduced in an order approximating patentee's and infringer's cases in litigation. Designed for students intending

to specialize in patent law; knowledge or experience in patent law helpful but not prerequisite. (Examination) (Fall—evening)

362 **Patent Office Practice** (2) Kayton, Sirilla

Substantive and procedural law of patents leading to issuance of patent, mainly related to proceedings before U.S. Patent Office. Obtaining and preserving earliest possible patent filing date; continuing applications, res judicata, novelty and nonobviousness requirements; substantive rules of priority of invention and related affidavit practice; nature of claims and formal defects; double patenting. Designed for students intending to specialize in patent law. Prerequisite: Law 359. (Examination) (Spring—evening)

363 **Fraud in Patent Practice** (2) Kayton

Procedural and substantive law of fraud and inequitable procurement in prosecution of patent applications before the U.S. Patent and Trademark Office. "Materiality," "reliance," and "scienter" criteria in fraud controversies; procedures used in motions to strike, and the striking of, patent applications in protests, reissues, and *sua sponte* proceedings of the Patent Office. Analysis of relationships among the New Reexamination Statute, Protests, the proposed Inter-Partes Protests, and the new-prior-art Reissues relative to fraud. For students intending to specialize in patent law. Prerequisite: Law 359 and 362. (Examination)

372 **Administrative Law** (3) Park, Banzhaf, Barron, Schwartz, Raven-Hansen

Study of the administrative process in executive and independent regulatory agencies; emphasis on judicial review. Formal and informal decision-making, investigation, planning, and public administration functions of the agencies as related to their legal limits and to the roles of lawyers in government and private practice. Relationships of agencies to the executive and legislative branches, to public and private interest groups, and to the social, political, and economic aspects of various philosophies of government regulation. Park and Banzhaf—(Examination) (Fall—day; spring—day and evening; summer 1982)

375 **Remedies** (3) Cibinic, Nash, Lowther, Park, Zubrow, Shreve, Trangsrud

Development and use of judicial remedies that give relief for past or threatened injuries to interests of personalty and property Remedial approaches include compensatory and punitive damages, injunctions, unjust enrichment, constructive trusts, equitable liens, tracing, subrogation, and specific reparation. Emphasis on comparing remedial options in fraud, mistake, duress, breach of contract, and abuse of fiduciary relationships. The grade *CR* (Credit) or *NC* (No Credit) only is given in sections taught by Lowther. Cibinic, Shreve—(Examination); Lowther, Nash—(Problem Assignments) (Fall and spring—day and evening)

377 **Legislation** (2) Zenoff

Legislative process and roles of participants in the process; operation of United States Congress and state legislatures, including fact finding, organization, procedure. Statutory interpretations emphasized to provide foundation for more advanced courses. (Examination)

385 **Trial Practice Court** (2) Pryor, Ryan, Kendrick, Skinker, Stevas, Altshuler, Seidel

Trial of assigned cases, trial techniques, pre-trial and courtroom procedures pursuant to federal rules. Students may repeat this course once for credit. Prerequisite: forty-two semester hours, including Law 218. Prerequisite or concurrent registration: Law 232. The grade *CR* (Credit) or *NC* (No Credit) is given for this course. (Fall and spring—day and evening)

389 **Medicine for Lawyers** (2) Hirsh

Survey of the basic medical sciences and the rudiments of clinical medicine as encountered in the practice of law. Medical terminology, the disease process, trauma, and industrial medicine. The application of this fundamental information is demonstrated in personal injury or negligence and malpractice litigation as well as in commitment and equitable proceedings. Emphasis on enabling the lawyer to communicate most effectively with medical specialists. (Examination) (Fall and spring—day)

390 **Law and Medicine** (2) Sharpe, Fiscina

Malpractice, insurance, and alternatives to professional liability litigation; securing and presenting medical evidence to prove causation and damages; chemical test data and behavioral science findings in court; entry into and practice of the professions; professional organizations; hospitals; professional service delivery; public policy intervention in medical science—for example, abortion, transplantation, and coerced treatment. (Examination) (Fall—evening)

391 **Federal Indian Law** (2)

Survey of the federal laws, regulations, and policies applicable to American Indians because of their status as Indians, including a review of the development of the fundamental legal doctrines (tribal sovereignty, federal supremacy in Indian affairs, the guardian-ward relationship, the trust responsibility) and the current legal status of tribal governments in the federal system. Special emphasis on current trends and conflicts in federal Indian legislation and policy, such as the implementation of the Indian Self-Determination and Education Assistance Act and the Alaska Native Claims Settlement Act, congressional programs of economic assistance to Indian tribes, tribal-state jurisdictional conflicts, and questions involving the protection and development of Indian resources. (Examination)

394 **Women and the Law** (2) Polikoff

An examination of the treatment of women in all areas of the law and of legal remedies for sex discrimination. Emphasis on constitutional law, criminal law, discrimination in the media, education, and employment. Students choose clinical projects or research papers on which to focus the semester's work. Enrollment limited to 30 students. (Research Paper) (Spring—day)

396 **Legal Activism** (2 or 3) Banzhaf

Study of the legal process, not to benefit individual clients, but as a powerful tool for affecting social change and advancing the public interest. Topics discussed in a 2-hour seminar meeting each week include principles of maximizing legal leverage, legal judo, guerrilla law, working with the press and Members of Congress, drafting of legal documents, unusual legal tools and tactics, negotiation, making money from public interest law, etc. Students may choose to bring a public interest legal action before an agency and/or in court, or undertake another legal action project, for 3 credits and receive a numerical grade. Alternatively, students may do research on a topic related to public interest law for 2 crdits on a *CR/NC* basis. (Fall—day)

397 **Disabled People and the Law** (2) Banzhaf

Examination of those areas in which persons with disabilities have traditionally been denied some right or benefit afforded other persons in our society, and have resorted to legal action; introduction to statutes and agencies designed to protect people with disabilities. Students may choose to prepare a research paper (and receive legal writing credit and a numerical grade) or to gain practical experience doing a clinical project (on a *CR/NC* basis). (Spring—day)

398 **National Center for Law and the Deaf** Banzhaf
Clinical Education Activities (1, 2, or 3)
Work with the National Center for Law and the Deaf in bringing legal information, services, and representation to the more than 13 million Americans who are deaf or hearing-impaired. The Center is designed to help make the hearing-impaired aware of their legal rights and to assist them in solving their legal and law-related problems. Students may participate in one or more projects: (1) counseling persons with hearing impairments about legal problems at a walk-in clinic usually held on the Gallaudet College campus; (2) preparing and participating in workshops for hearing-impaired persons to acquaint them with their rights and obligations under the law; (3) assisting in representing the interests of deaf and hearing-impaired persons in judicial and administrative proceedings; (4) preparing research papers on topics related to law and the deaf, or preparing handbooks explaining legal topics to the hearing impaired. Students may learn some sign language, but will be assisted by trained translators when dealing with deaf individuals. Approximately 60 hours of work per semester is required for each credit hour. Students may repeat this course for a maximum of eight semester hours of credit. This course may not be taken at the same time as Law 345, or any litigating activities in Law 346. The grade of *CR* (Credit) or *NC* (No Credit) is given for this course. (Fall, spring, summer—as arranged)

399 **Clinical Law Work (arr.)** Staff
Projects involving litigation, research, or public interest activities of a legal nature (including aid to indigents, support of public interest nonprofit corporations, and support of governmental agencies or courts) may be initiated and will be supervised by a faculty member. Projects must be approved in advance by the Law Center Supervisory Committee (three members) both as to whether the project is appropriate and as to the number of semester hours of credit to be granted. A maximum of 10 semester hours of credit may be taken in one or two semesters. This course is open to a limited number of third-year law students. The grade *CR* (Credit) or *NC* (No Credit) is given for this course. (Fall and spring)

INICAL LEGAL STUDIES

rector: E.S. Sirulnik

culty Advisors: D.P. Rothschild, E.S. Sirulnik, R.B. Stevenson, J. Banzhaf III, A.W. Reitze

lated Courses

343 *Law Students Civil Rights Research Council (LSCRRC)*
345 *Law Students in Court*
346 *Legal Aid*
396 *Legal Activism*
398 *National Center for Law and the Deaf*
399 *Clinical Law Work*
459 *Problems of the Consumer*
513 *Environmental Litigation*
516 *Clinical Studies in Environmental Law*
579 *Clinical Studies in Urban Law*
596 *Graduate Clinical Studies*

Advanced Courses

ADMINISTRATIVE LAW: ECONOMIC REGULATION

Faculty Advisers: R.E. Park, G.E. Weston

401 **Administrative Law Seminar** (2) Helfer
Group study of specific problems in administrative law. Topics will vary. In the fall 1982 semester the course will focus on federal regulation of financial institutions. Prerequisite: Law 312. (Research Paper) (Fall—day)

403 **Public Economic Policy and the Law** (2) Peterson
Interrelation of law and economics in such subject-matter categories and decisional contexts as economic regulation of industry, fiscal policy planning, government research and development practices, foreign trade and investment, and public spending priorities. (Research Paper) (Spring—evening)

404 **Securities Regulation** (2) Stevenson, Black, McCaw, Steinberg
State and federal laws governing offering and distribution of securities to the public by corporate issuers and others, regulation of securities markets, rights and liabilities of purchasers under such statutes. Emphasis on statutes administered by Securities and Exchange Commission. Stevenson, Black, McCaw—(Take-home Examination); Steinberg—(Examination) (Fall—evening; spring—day)

405 **Regulation of Securities Markets** (2) Steinberg
Operation of over-the-counter and exchange markets, including competitive and monopolistic practices in each market; relationship of antitrust laws and securities regulations to concept of a free and open market place; role of regional exchanges and third market in providing competitive element in market; advantages and disadvantages of a fragmented market; minimum fee structure; rebates and their effect on merchandising of securities and financial soundness of industry; use and availability of economic data in evaluating performance of market place. The seminar will examine matters directly of interest to graduate law students, lawyers, economists, and political scientists. (Take-home Examination) (Spring—evening)

406 **Regulation of Securities Trading** (2) Stevenson
Study of the portions of the Securities Exchange Act of 1934 directed toward the regulation of the trading of securities, including Section 16(b), Rule 10b-5, and the regulation of tender offers. Substantive aspects of these various statutes and rules and enforcement by the SEC and in private actions. Some time may also be spent on the regulation of investment companies. (Examination)

407 **Seminar: Law and Economic Development** (2) Stevenson
An investigation of legal problems relevant to economic development in the Third World. Economic aspects of economic development, principal issues relating to the impact of domestic laws on economic development, private legal aspects of transactions that may assist in economic development, and some of the principal policy issues in the so-called North-South dialogue. Discussion of student research papers may play a major role in the organization of the class. (Research Paper)

408 **Seminar: Health Care Delivery Systems** (2) Steele
(Formerly Law 485)
Study of the role of the lawyer in existing and proposed national systems for delivering health care. Students will gain familiarity with the con-

cepts and terms in health care delivery by working with issues in the design, finance, and administration of existing arrangements; examination of the means of reconciling the expectations of various groups of health care service consumers and providers. (Research Paper) (Spring—evening)

411 **Administrative Practices and Procedures (Food and Drug Administration)** (2) Rothschild, Chasen

The study of FDA administrative procedures for the purpose of investigating the significance that administrative practice has on regulatory activity. The course will consider FDA rulemaking procedures in general, a step-by-step consideration of the various hearing procedures now available under the new agency practices and procedures, and problems designed to enable the practical application of rulemaking and hearing procedures to achieve resolution. Prequisite: Law 372. (Research Paper) (Fall—evening)

412 **Food and Drug Law** (2) **Kaplan, Becker**

The Federal Food, Drug, and Cosmetic Act, and related laws. Consumer, government, and industry viewpoints. (Choice of Research Paper or Examination) (Spring—evening)

413 **Public Policy and Mass Media** (2) Barron, Secrest

Institutional structure of mass media and their interrelationships; psychological aspects of mass communications; continuing adjustments among public interest goals, the economic system, and technological developments; influence of and controls exercised by government, other institutions, and private groups; conflict between freedom of speech of the media and other major community interests; the media's relationships to the interests of dissident and minority groups and the access of these groups to the media. Barron—(Examination or Research Paper); Secrest—(Research Paper) (Fall—day; spring—evening)

414 **Regulated Industries** (2) **Park, Schechter**

Substantive problems of business regulation in terms of natural monopolies, licensed industries, subsidized industries, and safety regulation. Typical problems raised include the role of intervenors, the impact of regulation upon management and market behavior, the uses and abuses of economic evidence, the role of agencies' staffs, interagency planning and regulation, and the effects of judicial and legislative review. Each student selects one industry and develops an insight into economic regulation in terms of that industry's firms, market structure, growth and development, trade associations, and regulatory agencies. (Research Paper)

415 **Practical Economics for Lawyers** (2) Raven-Hansen

For students with no prior economics training. No calculus or statistics is required. Key principles of economic theory are presented, with focus on the application of these principles to antitrust, regulatory impact analysis (including environmental cost benefit analysis), utility ratemaking and regulation, and deregulation. The course also considers preparation and examination of economic expert witnesses in these areas of the law. (Examination)

417 **Seminar: Trade Regulation** (2) Weston, Bodner

Group study of current problems relating to unfair trade practices and federal antitrust laws. (Research Paper) (Spring—evening)

aster of Laws candidates in the area of Administrative Law: Economic Regu-ion who have not taken the following courses or their equivalent as part of Juris Doctor or Bachelor of Laws program should include them in their Mas-'s program.

329 *Unfair Trade Practices*
330 *Federal Antitrust Laws*
372 *Administrative Law*

Other Related Courses
505 *Intergovernmental Relations I*
506 *Intergovernmental Relations II*
518 *Use and Control of Nuclear Energy*
571 *Land Development Planning*

CORPORATION LAW

Faculty Advisers: R.B. Stevenson, Jr., L.D. Solomon

424 **Business Planning** (2) Stevenson, Flyer, Lewis, Berkeley, Press, Cohen, Parker

Integrated study of corporate, financial, tax, accounting, and SEC aspects of the following: organization of a small corporation; organization of a public corporation; stock dividends, recapitalization, and stock repurchases in the context of conflict between active stockholders of a closed corporation and the family of a deceased active stockholder; corporate liquidations; corporate mergers and acquisitions; and divisions of corporations. Prerequisite: Law 312, 336, and 340. Enrollment may be limited by the professor. Stevenson, Berkeley, Press—(Problem Assignments); Flyer, Lewis—(Examination) (Fall and spring—evening; summer 1982)

426 **Introduction to International Economic Law** (2) Stevenson

Principles and processes of international law relevant to transnational economic transactions between private parties, including protection of aliens (individual and corporate) within national legal systems; protection by states of the economic interests of their nationals; act of state doctrine, expropriation, and the protection of alien-owned property; development of international law affecting transnational economic transactions through the decisions of national tribunals and through treaties and international agreements, adjudicatory jurisdiction of municipal tribunals and the enforcement of foreign judgments in the international context; international commercial arbitration; special problems of national and international regulation of transnational business transactions. Law 426 is recommended as a foundation for Law 427. (Examination) (Fall—day)

427 **Legal Aspects of International Business Transactions** (2) Stevenson, Goldstein, Iwry

U.S. law and practice relating to the formation and dissolution of international business agreements; brief treatment of other common and civil law systems, multinational codes, and multilateral agreements; U.S. and developing country regulation of foreign investment; concession, licensing, distributorship, and financial agreements; sources of finance; transnational reach of U.S. legislation, including taxation, antitrust, foreign payments, protection of foreign investment, exhaustion of local remedies and espousal; nationalization of investments; sovereign immunity; litigation in a transnational setting, including choice of law and forum, jurisdiction, discovery, enforcement; arbitration. Occasional guest lecturers. Emphasis on current problems. Stevenson—(Choice of Research Paper or Examination); Goldstein, Iwry—(Examination) (Spring—evening)

Master of Laws candidates in the area of Corporation Law who have not taken the following courses or their equivalent as part of a Juris Doctor or Bachelor of Laws program should include them in their Master's program.

312 *Corporations*
313 *Sales and Sales Financing*
329 *Unfair Trade Practices*
330 *Federal Antitrust Laws*
340 *Taxation—Federal Income, Corporations and Shareholders*

her Related Courses
331 *Product Liability*
403 *Public Economic Policy and the Law*
406 *Regulation of Securities Trading*
407 *Seminar: Law and Economic Development*
417 *Seminar: Trade Regulation*
431 *Government Procurement Law*
525 *Copyright Law*
526 *U.S. Trademark Law: Selection, Use, Registration, Protection, and Franchising of Trademarks*
555 *Taxation—Special Corporation Problems*
562 *Income Taxation of Foreign Business and Investment*

OVERNMENT PROCUREMENT LAW

culty *Advisers:* J. Cibinic, Jr., G.J. Ginsburg, R.C. Nash, Jr.

431 **Government Procurement Law** (4) Nash, Cibinic
Survey of the law pertaining to government procurement, including an analysis of the unique features of government contracting and a discussion of the functions of Congress, the executive branch, and the courts in the procurement process. The course focuses on the contract formation process, including techniques for awarding contracts and litigation and protests involving awards. Law 355 is the substantial equivalent of this course. (Examination and Problem Assignments) (Fall—evening)

432 **Performance of Government Contracts** (4) Nash, Cibinic
Discussion of the substantive problems that most frequently arise during the performance of government contracts. Interpretation of specifications and the most generally used contract clauses, and analysis of the rights of the parties when performance in accordance with the terms of the contract is not obtained. Analysis of the methods which can be used by the parties to a government contract to obtain legal relief, including detailed coverage of the disputes procedure, actions for breach of contract, and forms of equitable and extraordinary relief. (Examination and Problem Assignments) (Spring—evening)

435 **Seminar: Government Contracts** (2) Nash, Cibinic
Research and discussion of selected problem areas. (Research Paper) (Spring—day)

her Related Courses
424 *Business Planning*
427 *Legal Aspects of International Business Transactions*
442 *Labor Standards*
446 *Equal Employment Opportunity*
450 *Equal Employment Claims and Litigation*
505 *Intergovernmental Relations I*
506 *Intergovernmental Relations II*
518 *Use and Control of Nuclear Energy*
535 *Negotiation: Concepts and Techniques*

LABOR LAW

Faculty Advisers: J.M. Albert, L.S. Merrifield, D.P. Rothschild

440 **Seminar: Comparative Labor Law** (2) Merrifield
A comparison of different systems for the regulation of labor and industrial relations in selected countries. Group study of how common problems are handled under these systems; topics may include legal status of collective agreements, worker participation in decision-making, limits on bargaining weapons, procedures for settlement of grievances and jurisdictional disputes, protection against unfair dismissal, and reconciliation of individual, minority, and majority group interests. (Research Paper) (Fall—day)

441 **Seminar: Disability Problems** (2)
Workman's compensation law, extension of no-fault principle into motor vehicle area, and national health problems. (Examination)

442 **Labor Standards** (2) Ginsburg
Analysis of the Fair Labor Standards Act, its scope and exemptions, the Civil Rights Act and other labor statutes; the laws establishing labor standards for government contracts, including the Davis-Bacon Act, Walsh-Healey Act, Service Contract Act, and Work Hours Act; the role of the Department of Labor, the Comptroller General, and the contracting agencies in interpretation, administration, and enforcement of these statutes. (Examination) (Spring—evening)

443 **Labor Relations in the Federal Service** (2) Tobias
Study of the Civil Service Reform Act, with emphasis on the structure and case law developed by the Federal Labor Relations Authority, Federal Service Impasses Panel, and Merit Systems Protection Board. Parallels are drawn between federal sector, non-federal public sector, and private sector decisions. (Research Paper) (Fall—evening)

445 **National Labor Relations Board Procedures** (2) DuRoss
A survey of the National Labor Relations Board's unfair labor practice procedures. The course is designed to provide a broad exposure to all aspects of the National Labor Relations Board's practice, including a survey of the remedies and the particular procedures utilized by the National Labor Relations Board to secure such remedies. Prerequisite: a basic labor law course. (Research Paper) (Fall—evening)

446 **Equal Employment Opportunity** (2) Silberman
This course covers the spectrum of federal laws and executive orders relating to all types of discrimination in employment, including Title VII of the Civil Rights Act of 1964, as amended by the Equal Employment Opportunity Act of 1972; the Equal Pay Act of 1963, as amended in 1972; the Age Discrimination in Employment Act; the Civil Rights Act of 1866; the Fourteenth Amendment; the National Labor Relations Act; Executive Orders 11246 and 11375 relating to government contractors (including the "Philadelphia Plan" and other government-imposed "affirmative action" plans and bid conditions, and Revised Order No. 4 relating to sex discrimination). The course includes the substantive and procedural rights available to employees of firms doing business with the government, as well as those of other private firms and state and local government agencies subject to the above federal legislation. (Examination) (Fall—evening)

447 **Seminar: Labor Law** (2) Merrifield
Group study of contemporary problems of labor law. Prerequisite: Law 341. (Research Paper) (Spring—day)

448 **Seminar: Labor Litigation** (2) **Driesen**
Examination of the Supreme Court's work in the labor law field, with emphasis on current and recently decided cases. Facets of Supreme Court practice and procedure that bear upon labor litigation; litigation strategies and objectives of institutions and practitioners who practice labor law before the Supreme Court. Each student will study intensively the labor relations opinions of an individual Justice, followed by participation in a mock conference of the Justices on a pending or recent case and preparation of a paper analyzing the Justice's views on important labor law issues. Prerequisite: Law 341. (Research Paper) (Spring—evening)

450 **Equal Employment Claims and Litigation** (2) **Hartman**
Litigation in federal court of a claim of employment discrimination; problems faced by attorneys for both plaintiff and defendant; practice in drafting pleadings which the attorneys for the parties would prepare in litigating a claim of employment discrimination. (Examination) (Spring—evening)

451 **Occupational Safety and Health Legislation (OSHA)** (2) Savelson
This course will review the history of safety and health law in the United States and present an analysis of the interrelationship of various federal and state safety and health laws. The focal point will be the Occupational Safety and Health Act of 1970. By use of commission and court decisions, the course will survey the jurisdictional applicability of the Act and the responsibilities imposed thereunder, and will present an analysis of enforcement and adjudicative procedures. (Examination) (Fall—evening)

452 **Seminar: Public-Sector Labor Law** (2) **Nassau**
Group study of contemporary problems of labor law. The course is devoted exclusively to problems of the public sector. (Research Paper) (Spring—evening)

ster of Laws candidates in the area of Labor Law who have not taken the owing courses or their equivalent as part of a Juris Doctor or Bachelor of ws program should include them in their Master's program.

339 *Collective Bargaining and Labor Arbitration*
341 *Labor Law*

er Related Courses
459 *Problems of the Consumer*
460 *Current Problems in Civil Rights*
566 *Taxation—Deferred Compensation II*

W AND POVERTY

ulty Advisers: D.P. Rothschild, J.E. Starrs

459 **Problems of the Consumer** (arr.) **Rothschild and Staff**
(1) *Consumer Protection Center*—Clinical treatment of consumer protection. Students engage in one or more of a number of the Center's projects. For example, "Consumer 9" is a project which solves problems received in writing or by telephone for a nightly television show. "Consumer H-E-L-P" places students in telephone contact with inner-city consumers. The cluster intern program places law students with the District of Columbia Office of Consumer Protection. The Center's federal programs allow students to gain experience in regulatory agencies. Students may also write and publish in the *Consumer Protection Reporting*

Service. Minimum of eight hours work commitment each week; two-hour weekly seminars required in addition for 3 credits. May be repeated once for a total credit not to exceed six hours.

(2) *Bankruptcy Clinic*—Open to second- and third-year students. Students participate in negotiations with creditors, counsel clients in financial matters through intensive interviews, and prepare legal petitions in bankruptcy that may be necessary to assist clients. May be taken for two or three credits. One and one-half hour weekly seminar.

The grade *CR* (Credit) or *NC* (No Credit) is given for both sections of this course. (Fall, spring, and summer—day)

Other Related Courses

441 *Seminar: Disability Problems*
475 *Law and Criminology I: Search for the Causes of Criminal Behavior*
476 *Law and Criminology II: Society's Responses to the Criminal Offender*
560 *Taxation—State and Local*
571 *Land Development Planning*
575 *Community Economic Development*
592 *Seminar: Constitutional Law*

LAW, PSYCHIATRY, AND CRIMINOLOGY

Faculty Advisers: T.F. Courtless, Jr., E. Zenoff, G.M. Caplan

473 **The Crime Lab, the Forensic Scientist, and the Criminal Lawyer** (2) Starrs, Melson

Designed to acquaint the student with the operations of a modern crime laboratory and the courtroom acceptability of testimony of forensic scientists and other evidence on laboratory test results. Identification of individuals (fingerprints, palmprints, footprints, voiceprints, anthropological reconstruction, hair identification, and serology), identification of objects (ballistics, handwriting, typewriting, fiber identification, paints, varnishes, glass, wood, and paper), toxicology, pathology, forensic use of the microscope and the camera, the coroner and the medical examiner systems, and drug law enforcement. Visual aids, crime laboratory guest lecturers, and field trips to crime laboratories. (Research Paper) (Spring—day, summer 1982)

475 **Law and Criminology I: Search for the Causes of Criminal Behavior** (2) Courtless

Role which criminological knowledge of crime causation may play in assisting lawyers to appraise the effectiveness of various alternative social and legal devices in controlling deviant behavior. The search for factors related to criminal behavior will be developed historically, with emphasis on current causal theories developed by various disciplines. Model as well as operational penal codes, sentencing and probation practices, and specialized facilities will be analyzed in terms of their relationship to such casual theories. (Research Paper) (Fall—day)

476 **Law and Criminology II: Society's Responses to the Criminal Offender** (2) Courtless

Study of the development and current use of society's three major approaches to the handling of offenders: punitive, mechanical, and correctional. Emphasis on society's changing responses to criminal and delinquent behavior, and research findings concerning effectiveness of these responses. Analysis of treatment strategies to facilitate communication between members of the legal profession and behavior scientists charged

with effectuating these strategies. Prerequisite: Law 475. (Research Paper) (Spring—day)

477 **The Police and the Community** (2) Courtless
Problems and potential of contemporary urban law enforcement; the role and perspective of the police officer; the police *qua* organization; "styles" of law enforcement; law enforcement in the inner city; relationship with ethnic minorities; civil disorder; police-community relations; methods in arrest and investigation; complaint review procedures; science and technology in law enforcement; police handling of juveniles; crime and crime statistics. (Problem Assignments)

479 **Seminar: Criminal Practice** (2) Foster, Weisberg
Tactical and practical applications of criminal law; mastery of techniques in trying criminal cases. Class sessions built around mock problems based on actual criminal cases; student role-playing as defense attorneys and prosecutors. All phases of criminal trial work covered—client relations, investigation, discovery, trial preparation; particular emphasis on courtroom techniques—direct and cross examination, impeachment, refreshing recollection, laying foundations for exhibits, argument, and courtroom demeanor. Though many of the mock problems are written from a defense viewpoint, techniques taught are relevant to both prosecution and defense. Enrollment limited to 15 third-year and graduate students. Prerequisite: Law 334. Students may elect to receive either a numerical grade or the grade *CR* (Credit) or *NC* (No Credit). (Fall—evening)

480 **Law of Criminal Corrections** (2) Cripe
Study of two principal areas: (1) sentencing procedures, including probation, parole, and imprisonment; (2) legal rights of prisoners. Enrollment limited to 25 students. (Examination) (Fall—evening)

481 **Seminar: Drugs and the Law** (2) Sirulnik, Meyers
A study of federal and state laws controlling illicit drugs, including the historical evolution of these laws, current offenses and penalties, constitutional limits on the criminal sanction, enforcement practices, and sentencing considerations. Alternative models for controlling drugs, including decriminalization and legalization. Five class sessions will be devoted to mock criminal trials at which student teams conduct direct and cross-examination of guest expert witnesses in the field. Graded on the basis of assigned memoranda pertaining to the legal issues involved in the mock hearings. (Writing Assignments) (Spring—day)

486 **Seminar: Law and Psychiatry** (2) Zenoff, Zients
Designed to expose the lawyer to basic constructs of psychiatry and psychology and to explore their implications in legal rules and practice. Psychiatrists and psychologists actively involved in teaching process. Topics include psychological testing and other assessment techniques, psychiatric evaluations and reports, child custody and other family law issues, privilege and confidentiality, competency in civil and criminal contexts, criminal law matters (including criminal responsibility and dispositional issues), civil commitment, right to treatment, right to refuse treatment, experimental procedures, and informed consent. Problems of counseling, legal ethics, preparation for trial, direct and cross examination, and other aspects of practice considered. There is ordinarily at least one session in a mental institution. (Choice of Research Paper or Examination) (Spring—day)

487 **Juvenile Justice** (2) Zenoff
Exploration of the rights of children in intra-family disputes and in conflicts between the child and the state. Includes the rights of children to

life (abortion and medical care), a home (neglect and adoption), education, liberty (status offenses, delinquency, hospitalization for mental disability). (Research Paper)

Other Related Courses

390 *Law and Medicine*
591 *Legislative Drafting*
592 *Seminar: Constitutional Law*

LAND USE MANAGEMENT AND CONTROL

Faculty Advisers: J.M. Brown, L.A. Schiller, J.P. Chandler

501 **Land Development Law** (3) Brown
Study of the basic public and private means used by society to manage and control land use, such as zoning, subdivision regulation, pending codes, eminent domain, and privately contracted conditions, covenants, and restrictions. Identification and analysis of emerging new land control processes and the roles played by public and private entities involved in or affected by land use management and control efforts at the various echelons of government. Students participate in a game-simulation process representing a specific complex situation in land use conflicts involving their inherent technological, social, economic, political, and legal elements. In the model situation students will assume roles as attorneys and work with assigned "clients." (Client-oriented written work and class participation). Enrollment limited by the instructor. (Fall—day; summer 1982)

503 **Land Development Planning** (2) Kaufman
(Formerly Law 572)
Selected problems in urban and regional planning: applications of zoning, urban renewal, and special programs available for the implementation of development plans. Enrollment limited by the instructor. (Writing Assignments and Examination) (Spring—evening)

504 **Seminar: Current Problems in Land Use Controls** (2) Brown, Schiller
New and emerging concepts of regionalism considered in the light of actual problem situations and attempts being made by various echelons of government to provide effective and equitable land use management and control. Examination of actual problem areas of major concern, including constitutional, administrative, political, judicial, social, economic, and technological elements. Functional planning and decision-making with respect to selected problem areas and their strategical and tactical transactions examined within the compass of the broader policy considerations involved. Guest lecturers; clinical exposure to various government agencies responsible for cooperating with the selected problems. (Research Paper)

505 **Intergovernmental Relations I** (2) Nash
Study of federalism, emphasizing current techniques for achieving cooperation and coordination between federal, state, and local governments. Detailed consideration of devices used, including interstate compacts, grants-in-aid, and exercise of regulatory powers. (Research Paper) (Fall—day)

506 **Intergovernmental Relations II** (2) Nash
Advanced seminar on multi-government activities and current topics on intergovernmental relations. (Research Paper)

Master of Laws candidates in the area of Land Use Management and Control who have not taken the following courses or their equivalent as part of a Juris

octor or Bachelor of Laws program should include them in their Master's ogram.

327 *Modern Real Estate Transactions*
372 *Administrative Law*
508 *Environmental Law I*
509 *Environmental Law II*

ier Related Courses

460 *Current Problems in Civil Rights*
510 *Water Resources Law*
511 *Environmental Planning*
518 *Use and Control of Nuclear Energy*
558 *Taxation—Real Estate and Income*
560 *Taxation—State and Local*
572 *Land Development Planning*
591 *Legislative Drafting*
593 *Seminar: American Legal History*

VIRONMENTAL AND ENERGY LAW

ulty Adviser: A.W. Reitze, Jr.

508 **Environmental Law I (3)** Reitze
A survey of the laws administered by the U.S. Environmental Protection Agency—water pollution, noise, toxic substances, etc. An in-depth analysis of the Clean Air Act, using that Act to focus on legal problems common to environmental law. (Examination) (Fall—day; spring—evening)

509 **Environmental Law II (3)** Reitze
A continuation of Law 508. Topics covered in this course vary. (Examination)

510 **Water Resources Law (2)** Hedeman
Federal/State powers over water; riparian and prior appropriation doctrines; Indian and reserved rights; groundwater law. Federal programs for water resources development; federal permit programs. Wetland protection and coastal zone management. (Examination) (Fall—evening)

511 **Environmental Planning (2)** Schnidman
Introduction to environmentalism in land use planning, zoning, subdivision controls, growth control. State and federal land use planning. Case studies of environmentally sound planning. Enrollment limited to 25 students. A second-level property course is recommended prior to this course. (Research Paper)

512 **Energy (2)** Hollis
Survey of federal energy regulation of the major energy industries. Emphasis on federal controls affecting the oil, natural gas, coal, and electric industries. The course approaches energy regulation from a statutory and case standpoint, and also deals with practical, procedural issues. Enrollment limited to 35 students. Recommended for third-year students. (Examination) (Fall—evening)

513 **Environmental Litigation (2)** Vitt
Special problems of environmental lawsuits. Topics include pleadings, procedural problems, selection of the proper court, problems of proof, remedies, selection of parties, discovery techniques and trial preparation,

and the use of expert witnesses and scientific evidence. Prerequisite third-year or graduate status. Enrollment limited to 35 students. (Writing Assignments) (Spring—evening)

514 **Natural Resources Law** (2) Kirby, Moorman
Introduction to public lands; recreation, forestry, grazing, and mining law. Continental shelf development, Alaskan development, western energy development. Wilderness Act, wild and scenic rivers, national trails. Wildlife issues are a major focus of the course. Recommended for second- or third-year students. (Examination) (Fall—evening)

515 **Pollution Control Law** (2) Buente, Stever
A detailed analysis of the Federal Clean Water Act. Other federal statutes with water pollution implications are examined, including the Marine Protection, Research and Sanctuaries Act, Ports and Waterways Safety Act, Outer Continental Shelf Lands Act, Deepwater Ports Act, and Safe Drinking Water Act. Recommended for second- or third-year students. (Examination) (Spring—day)

516 **Clinical Studies in Environmental Law** (2, 3, or 4) Reitze
The student works on a project in the environmental law field under the supervision of both the faculty director of the program and a lawyer practicing environmental law. The project may involve working with a government agency, a congressional committee, a private practitioner, or a nonprofit public-interest environmental organization. Admission to this course requires second-semester second-year, third-year, or graduate standing and permission of the Director of the Environmental Law Program. Students who have mastered the fundamentals of environmental law are selected for this course. Normally this will require completion of at least Law 508. Students may repeat this course for a maximum of 8 semester hours of credit. The grade *CR* (Credit) or *NC* (No Credit) is given for this course. Five hours of work per week are required for each credit. (Fall and spring—day)

518 **Use and Control of Nuclear Energy** (2) Malsch
Development of law and legal institutions to deal with scientific developments in nuclear energy. Laws and regulations concerning peaceful uses of nuclear energy, including licensing, safety, environmental, security, and antitrust considerations. (Research Paper) (Spring—evening)

Master of Laws candidates specializing in Environmental and Energy Law or Land Use Management and Control may use the following courses to complete the degree requirements.

598 *Research in Public Law*
599–600 *Thesis*

Other Related Courses

327 *Modern Real Estate Transactions*
391 *Federal Indian Law*
431 *Government Procurement Law*
451 *Occupational Safety and Health Legislation*
501 *Land Development Law*
504 *Seminar: Current Problems in Land Use Controls*
532 *International Law of the Sea*
560 *Taxation—State and Local*
572 *Land Development Planning*
591 *Legislative Drafting*

ATENT AND TRADE REGULATION LAW

culty Advisers: I. Kayton, G.E. Weston

522 **Patent and Know-how Licensing** (2) Brunsvold
The business and legal criteria necessary to implement and maintain successful licensing programs; emphasis on the strategy and techniques that permit a proprietor of intellectual property to effectively exploit his status as the owner of a unique form of property. Subject areas covered are business objectives in licensing; legal outline of licensing situations; rights and duties of license parties; factors in selecting which inventions to license—financial, legal, and commercial; finding and selecting the right licensees; determining and negotiating the terms and clauses of the contract; administering and enforcing the license; antitrust and misuse constraints on the business and law of licensing; tax factors affecting the patent and know-how contract; special problems in trade secret, know-how, and show-how contracts; international licensing. Prerequisite: Law 359. (Choice of Research Paper or Examination) (Spring, odd years—evening)

523 **Court Review of Patent Office Decisions** (2) Dunner
Procedure and procedural law involved in appealing to the U.S. Court of Customs and Patent Appeals and the U.S. District Courts from administrative decisions in the U.S. Patent Office. Designed to provide an exhaustive step-by-step procedural progression through *ex parte* and *inter partes* patent and trademark appeals. Emphasis on the forms used in the many motions and proceedings before the U.S. Court of Customs and Patent Appeals and the District Courts required to perfect an appeal. Attendance at and critique of actual court proceedings. Introductory material includes administrative appeals before the U.S. Patent Office Board of Appeals. Prerequisite: Law 359 and 362, or the equivalent in experience. (Examination) (Spring—evening, even years)

524 **Chemical Patent Practice** (2) White
Seminar covering patent application preparation, prosecution, appeals, and licensing which are peculiar to chemical patent practice. Prerequisite: Law 359 and 362, or comparable experience in the practice of patent law. (Examination) (Fall, even years—evening)

525 **Copyright Law** (3) Moore
Historical background; formalities and essentials in securing a copyright; subject matter of copyright; remedies; international aspects of copyright under Berne Union, Universal Copyright Convention, Inter-American Convention; copyright licensing and performing rights societies. (Examination) (Spring—evening)

526 **U.S. Trademark Law: Selection, Use, Registration, Protection, and Franchising of Trademarks** (2) Hefter
Procedural and substantive law on use, registration, and protection of trademarks, including detailed registration procedure in the U.S. Patent and Trademark Office, common law rights to marks, and licensing and franchising arrangements. Prerequisite: Law 329. (Examination) (Fall—evening, odd years)

527 **Advanced Topics in Patent Law** (2) Kayton
Seminar directed to selected, advanced, and usually topical aspects of patent law. Topics may include the Re-examination Statute of 1981, procedure in patent infringement appeals to the U.S. Court of Appeals for the Federal Circuit, patent and copyright protection of living microorganism and genetically engineered sequences, fraud in patent practices, and advanced aspects of practice before the U.S. Patent and Trademark

Office, including enter partes interference practice. Prerequisite: Law 359 and 362. (Research Paper) (Fall—evening, even years)

528 **Patent Interference Practice** (2) Klitzman
Procedure and practice in inter partes determination of priority of invention in the U.S. Patent Office. Topics: conception, reduction to practice, diligence, corroboration, preliminary statements, motions, and testimony practice and final hearing. Also covered are current problem areas such as inventor determination, discovery, and privilege. Students required to draft procedural document selected from categories of preliminary statements and various interference motions. Prerequisite: Law 359 and 362. (Examination) (Spring 1982—evening; spring of odd years thereafter)

529 **Research in Patent, Trademark, and Copyright Law** (2) Kayton
Prerequisite: Law 359, 362, and related courses; and a *B* average. Request in writing, with proposed outline of topic of research, must be submitted to the Dean at least one month prior to registration day. Work must be completed within the semester and paper submitted not later than last day of classes. Graduate students may repeat this course once for credit with the approval of the Dean. (Research Paper)

Master of Laws candidates in the area of Patent and Trade Regulation Law who have not taken the following courses or their equivalent as part of a Juris Doctor or Bachelor of Laws program should include them in their Master's program.

329 *Unfair Trade Practices*
330 *Federal Antitrust Laws*
359 *Patent Law*
362 *Patent Office Practice*

Other Related Courses

417 *Seminar: Trade Regulation*
431 *Government Procurement Law*
585 *Computers and the Law*
589 *Seminar: Law of Privacy*

INTERNATIONAL AND COMPARATIVE LAW

Faculty Advisers: International Law—W.T. Mallison
Comparative Law—G.R. Delaume, W.T. Mallison

The basic courses for the International and Comparative Law Program are Law 303, *International Law and World Order*, and Law 304, *United Nations Law and World Order*. Either of these courses provides an important background for the following advanced seminars. Law 307, *Comparative Law*, is also recommended for background.

531 **International Law of Air and Space** (2) Dembling, Hosenball
Study of the development of international law relating to the use of air space and outer space; analysis of air and space treaties in force; the role of various intergovernmental and nongovernmental international organizations; consideration of special problems such as liability resulting from space activities, space technology and arms control, and pollution and contamination of outer space: earth resources, sensing, etc. Enrollment limited to 25 students. (Research Paper) (Fall—evening)

532 **International Law of the Sea** (2) Doyle
International law affecting allocation of authority over ocean space. Development of international law concerning territorial sea, contiguous zone,

high seas, continental shelf, and deep seabed. Current legal and policy issues associated with these areas. (Examination) (Spring—evening)

533 **International Humanitarian Law of Coercion Control** (2) Mallison
Process of legal decision concerning international conflicts and civil wars, including the protection of war victims, control of international terrorism, problems concerning weapons of mass destruction, war crimes and punishment, and problems of preserving human and material values by transforming coercion situations to minimum order ones. Consideration will be given to the four Geneva Conventions of 1949 for the Protection of War Victims, the Geneva Protocols of 1977, the role of the International Committee of the Red Cross, and current problems in the application of humanitarian law. (Research Paper)

534 **U.S. Foreign Relations Law** (2) Chandler
Seminar involving the study of foreign relations law. Materials to be read and discussed relate to the Constitutional and other public law problems which arise in the development and conduct of U.S. foreign relations. (Research Paper) (Fall—evening)

535 **Negotiation: Concepts and Techniques** (2) Ramundo, Tankel
Roles of the attorney-negotiator and principal (client) in the private, intra-organizational, and international negotiating environments; the "think negotiation" mentality and a suggested conceptualized approach to the negotiation process, including the definition of negotiation, four phases of negotiation, and operational checklists; negotiating techniques, including presentational considerations and the use of persuasion, tactics and ploys, and classic do's and don't's lists; theories of the opening position and concession-making. Practical exercises in the actual conducting of negotiations. Enrollment limited by the instructors. (Writing Assignments) (Spring—evening; summer 1982)

536 **Diplomatic and Consular Law and Practice** (1)
Development of diplomatic and consular relations between nations; legal rights, privileges, functions, and immunities of diplomatic and consular personnel; extent of immunity from jurisdiction of foreign government missions and representatives; problems of taxation affecting foreign government missions and personnel. (Research Paper)

537 **The International Law of Human Rights** (2) Fruchterman
Development of the rights of man from Grotius through the American and French Revolutions to the work of the United Nations in the field of human rights: the individual vis-a-vis the State; the regional approach to international protection of human rights, with emphasis on the European Convention; the inter-American, African, and Socialist approaches; human rights in armed conflict; and terrorism as a basic deprivation of human rights. (Research Paper) (Fall—evening)

542 **U.S. Regulation of International Trade** (2) Johnston
Study of theory and practical application of United States laws, regulations, and governmental infrastructure affecting international trade. Public international fora and agreements influencing U.S. regulation, e.g., GATT, the MTN, UNCTAD, and treaties of friendship, commerce, and navigation; constitutional basis for U.S. government regulation of international trade; exemplary areas of trade regulation: Export Administration Act, foreign assets control, tax, Foreign Corrupt Practices Act, Arab boycott regulations, antitrust, countervailing duties, import relief for domestic industries, East-West trade, generalized system of preferences and tariff nomenclature. (Examination) (Spring—evening)

546 **Soviet Law** (2) **Ramundo**
Concept of "socialist legality"; legal relationship of individual to state and other participants in Soviet society; role of Party in Soviet legal system. Soviet philosophy of law; state (constitutional) law: Soviet federalism, governmental apparatus, rights and obligations of citizenship; criminal law; property law; labor law; selected topics in civil law and procedure; international law. (Writing Assignments or Examination) (Fall—evening)

547 **Chinese Law** (2) **Hsia**
Emphasis on the legal system of Communist China; analysis of the constitutional law of China, including general principles, state structure, and rights and duties of citizens; a brief survey of the administration of justice—courts, procuratorates, and lawyers; marriage law; land law; counter-revolutionary act and other criminal statutes; principles of civil law; Communist Chinese concept of international law. (Research Paper) (Fall—evening)

548 **Law of the Near East** (2)
Law of the Arab countries, Turkey, and Iran, including basic principles of Islamic law, analysis of the present day codes, and investigation of the Western influences on laws of these countries. (Research Paper)

Master of Laws candidates in the area of International and Comparative Law who have not taken the following courses or their equivalent as part of a Juris Doctor or Bachelor of Laws program should include them in their Master's program.

302 *Admiralty*
303 *International Law and World Order*
304 *United Nations Law and World Order*
307 *Comparative Law*
309 *Conflicts of Laws*

Other Related Courses

427 *Legal Aspects of International Business Transactions*
440 *Comparative Labor Law*
518 *Use and Control of Nuclear Energy*
562 *Income Taxation of Foreign Business and Investment*
586 *Immigration Law*

TAXATION

Faculty Advisers: D.B. Weaver, L.D. Solomon, D.I. Kempler, T.S. Sims

551 **Taxation—Partnerships and Subchapter S** (2) Weaver, Sanders
Income tax problems of partnerships and tax-option corporations (Subchapters K and S of the Internal Revenue Code of 1954). Practice-oriented study of partnerships, including syndication, organization, and structure of entity, with emphasis on policy examination of areas of IRS principal concern, including tax shelters, disproportionate tax allocations, retroactive allocations, guaranteed payments to partners, contributions of capital, basis for gain or loss, non-recourse financing, "at-risk" rules, current and liquidating distributions, sale of partnership interests, collapsible partnerships, "like-kind" exchanges, termination, special basis adjustments, and distributions to retiring or deceased partners. Planning-oriented analysis of Subchapter S, including procedures for electing and terminating Subchapter S status, treatment of income and losses, limita-

tions on deductibility of losses, and how to avoid pitfalls. (Examination) (Spring—evening)

552 **Criminal Tax Prosecutions** (2)
Criminal tax statutes; elements of tax crimes; methods of proof; Internal Revenue summonses; privileged material; Department of Justice and Internal Revenue policy considerations; searches and seizures; grand jury proceedings; trial problems. (Examination)

553 **Seminar: Estate Planning** (2 or 3) Weaver, McCoy, Solomon, Edmisten
Study of the effective disposition of wealth by inter vivos gift and testamentary transfer; emphasis on income, estate, and gift tax considerations; use of the trust form in the transfer of wealth; use of insurance and jointly held property as part of the estate plan; planning for the continuation or disposition of the client's business interests. Preparation of an estate plan, with supporting documents is the major project for the course. Prerequisite: Law 325, 326, 336, and 338. Enrollment limited by the instructors. Solomon, Weaver (Problem Assignments); McCoy (Choice of Problem Assignments or Research Paper) (Fall—evening)

555 **Taxation—Special Corporation Problems** (2) Davis
Detailed study of the principal federal tax benefits of the corporate form of doing business. Consideration of problems involved in the tax planning of the corporate structure and corporate operation, including the tax definition of a corporation, the special deductions available to corporate payers, the compensation of the corporate executive and employee, the debt-equity question, the accumulated earnings tax, the personal holding company tax, multiple corporations, and consolidated returns. Survey of the types of corporations receiving special treatment under the Internal Revenue Code, such as financial institutions, real estate investment trusts, regulated investment companies, cooperatives, and small business corporations. Prerequisite: Law 340. (Research Paper or Examination) (Spring—evening)

557 **Taxation—Exempt Organizations** (2) Hopkins
Tax-exempt organizations: policy and practice of preferred tax treatment for selected organizations and gifts to them. Statutes, regulations, and IRS practice; legislative origins, judicial interpretations, and policy consideration. Tests of qualification, disqualification, and limited tax preference. Mechanics of securing and retaining exemption; qualified exemption; unrelated business income; private inurement, political activity. Denial or loss of exemption. Return and reporting requirements. Comparative tax treatment of nonexempt and nonprofit organizations. Special sanctions with respect to private foundations, managers, and donors for improper, excessive, or prohibited activities. Enrollment may be limited. Prerequisite: Law 336. (Examination) (Fall—evening; summer 1982)

558 **Taxation—Real Estate and Income** (2) Tucker
The effect of income taxes on the real estate market and real estate transactions: sales and exchange of real estate interests; various entities for the ownership and development of real estate; the impact of taxes on the landlord and tenant; the impact of taxes on the mortgagor and mortgagee, including the choice of financing techniques, such as the sale-leaseback; depreciation, amortization, and obsolescence; basis and basis adjustments; and casualties and other involuntary conversions. Prerequisite: Law 336 and 340. (Examination) (Spring—evening)

559 **Taxation—Oil and Gas** (2)
Application of federal income tax law to producing segment of oil and gas industry. Classification of interests; treatment of exploration and de-

velopment expenditures. Depletion allowance and concept of "economic interests." Sales vs. "leasing" transactions. Organization problems. Prerequisite: Law 336. (Examination) (Spring—evening)

560 **Taxation—State and Local** (2) Field
Taxation by state and local governments; problems of real and personal property taxation, sales and use taxes, business and personal income taxes. Limitations on taxation of interstate commerce. Congressional problems. (Choice of Research Paper or Examination) (Spring—evening)

562 **Income Taxation of Foreign Business and Investment** (2)
The provisions and policies of the federal income tax law applicable to foreign income, including considerations affecting the choice of methods of engaging in foreign business and investment, treatment of controlled foreign corporations, allocation of income in foreign commerce, credit for foreign taxes, principles and trends of U.S. tax treaties. (Examination) Sims

564 **Seminar: Special Problems of Tax Policy** (2)
Intensive study of selected aspects of the tax structure with primary attention given to the federal income tax. Problem areas are reviewed primarily from the standpoint of tax policy, including legal, economic, social, and practical considerations. Alternative solutions, including current legislative proposals, are examined. Prerequisite: Law 336, 340. (Research Paper)

565 **Taxation—Deferred Compensation I** (2) Chabot, Posner, I. Cohen
Tax and labor law consequences of deferred compensation. Examination of new standards imposed by Employee Retirement Security Act of 1974. Consideration of tax consequences of "unqualified" plans, lump sum distributions, individual retirement accounts, and new requirement that defined benefit plans be insured by the Pension Benefit Guaranty Corporation. Prerequisite: Law 336. (Problem Assignments and Examination) (Fall—evening)

566 **Taxation—Deferred Compensation II** (2) Chabot, Klevan, I. Cohen
Nonqualified arrangements: constructive receipt, cash equivalent, I.R.C. §§ 83 and 404, and individual retirement accounts. Qualified plans: deductions, distributions (annuities, lump-sum distributions, rollovers, employer stock), ESOPs, termination insurance, fiduciaries and service providers (reporting, disclosure, fiduciary standards, self-dealing), estate and gift tax, unrelated business income, simplified pension plans, and master and prototype plans. Law 336 recommended but not required prior to taking this course. Neither a tax background nor Law 565 (formerly Law 554) is prerequisite. (Examination) (Spring—evening)

567 **Seminar: Tax Practice and Procedure** (2) Lewis, Smiley
Review of the major areas of tax practice, including organization of the Internal Revenue Service, legislation, administrative regulations, tax planning, tax rulings, tax audit, settlement procedures, claims for refund, tax collection processes, criminal tax practice, and ethical problems in tax practice. Preparation of various documents is required. Prerequisite: 5 semester hours of taxation, including Law 336. (Problem Assignments) (Fall—evening)

569 **Community Property** (2) Weaver
Comparative study of the marital property law of eight states (Arizona, California, Idaho, Louisiana, Nevada, New Mexico, Texas, and Washington) which derive their law on this subject from Spanish or French civil law sources rather than the common law. Both the traditional concepts and the diverse modern statutory modifications are examined

Specific subjects include questions of classification of property as community or separate, consequences to the spouses, transferees, or creditors of each classification, and special constitutional, conflict of laws, and federal tax questions produced by the community property characterization. (Research Paper or Examination) (Fall—day and evening)

aster of Laws candidates in the area of Taxation who have not taken the fol-ving courses or their equivalent as part of a Juris Doctor or Bachelor of ws program should include them in their Master's program.

336 *Taxation—Federal Income*
338 *Taxation—Federal Estate and Gift*
340 *Taxation—Federal Income, Corporations and Shareholders*
351 *Law and Accounting*

her Related Courses

404 *Securities Regulation*
424 *Business Planning*
427 *Legal Aspects of International Business Transactions*

HER ADVANCED COURSES

575 **Community Economic Development** (2) Stevenson
A substantive study of the organizational, financial, and tax-planning aspects of nonprofit, cooperative, and small business organizations. Problems illustrating some of the legal considerations of a nonprofit organization and a small business. Consideration of the problems of economic development and current efforts to stimulate it. Enrollment limited to 25 students. Prerequisite: Law 312, 336. (Problem Assignments)

579 **Clinical Studies in Urban Law** (arr.) Sirulnik and Staff
(1) *Civil Litigation Clinic*—Open to third-year students. Students represent indigent litigants in the Small Claims, Family, Landlord/Tenant, and Civil Divisions of the D.C. Superior Court. Work responsibilities include client interviewing, investigation, settlement negotiations, preparation and argument of motions, as well as conducting actual trials. Two-hour weekly seminar.

(2) *Criminal Appellate Clinic*—Open to third-year students. Students participate in preparing actual criminal cases on appeal, starting with review of trial transcript and culminating with preparation of brief and oral argument before U.S. Court of Appeals for the District of Columbia Circuit. Appellate practice and procedure studied through texts; consultation with appellate judges, law clerks, and attorneys with cases pending on appeal; observation of arguments in the Supreme Court and the Court of Appeals. Two-hour weekly seminar.

For both sections, admission by permission of instructor; students must submit applications during spring term of preceding year. Must be taken for 4 credit hours per term for the entire academic year, or 2 credits carried over both summer sessions. (Fall, spring, summer)

585 **Computers and the Law** (3) Chandler
A critical study of selected major legal problems presented by new computer technology, including the impact upon legal doctrine and legal institutions. Jurimetrics, the theory of various uses that are and may be made of computers in legal research, the practice of law, and court administration will be examined. Familiarity with the rudiments of computer science or programming would be helpful, but is not required. (Examination) (Spring—evening)

586 **Immigration Law** (2) Stern-Boswell
Law and practice under the McCarran-Walter Act, involving questions of immigration, emigration, expatriation, nationality and naturalization. Consular, Immigration and Naturalization Service, and Labor Department practice. (Examination) (Fall—evening)

587 **Individual Rights and Liberties** (3) Dienes
Principles of equality and due process in the 5th and 14th amendments. The power of Congress to enforce the 14th amendment. Focus on individual rights and liberties under the U.S. Constitution. First amendment rights, particularly religion and speech clauses. The right of association. Other personal rights in the Bill of Rights. Methodology of judges in deciding cases involving individual rights and liberties, particularly the "balancing test" and the judges' views of societal interests. Prerequisite: Law 212. (Research Paper) (Spring—day)

588 **Legal Problems in Education** (2)
Public policy issues involving individual liberties and governmental obligations examined in the context of government's participation in education. Issues covered include legal framework within which states regulate schools, rights of students and teachers, obligations to avoid discrimination and provide equal educational opportunities, and role of courts, legislators, and educational officials in resolving such issues. (Research Paper)

589 **Seminar: Law of Privacy** (2) Park
A review of the law of privacy as it has developed in constitutional litigation, tort law, and state and federal statutes. Current developments and rationales for further expansions of privacy rights are considered. (Research Paper)

591 **Legislative Drafting** (2) Woodman, Smith
Advanced instruction and practice in legislative drafting; overview of legislative process with emphasis on legislative drafting. Enrollment limited to 30 students. (Problem Assignments) (Fall and spring—evening)

592 **Seminar: Constitutional Law** (2) Cheh, Dienes
Group study of contemporary problems in constitutional law; process of constitutional litigation; problems of effectuating constitutional guarantees. Limited enrollment. (Research Paper)

593 **Seminar: American Legal History** (2) Lowther
From the outbreak of the Revolution at Lexington and Concord to the death of John Marshall. An examination of men, events, and movements significant in the unfolding of our laws and legal institutions in this formative period of our national life, including a critical examination of the place of the lawyer in a revolutionary age. Comparison of the role of the lawyer during the politically and socially unsettled time of Marshall with the role of the lawyer in today's troubled scene. Members of the seminar present the results of their research and thought either by oral or written reports. The grade of *CR* (Credit) or *NC* (No Credit) is given for this course. (Problem Assignments) (Fall—day)

594 **Professional Responsibility** (2) Sharpe, Zenoff, Cibinic
Ethical problems in civil and criminal litigation. Loyalty to the client. Financing of legal services. Etiquette of acquiring and retaining clients. Procedures and problems in legal discipline. Special responsibilities of the government lawyer. Ethical conduct of judges. Issues in *pro bono publico* practice. Ethical responsibilities of law professors. Plea bargaining. Role of the American Bar Association. (Examination) (Spring—day and evening)

596 **Graduate Clinical Studies** (1, 2, 3, or 4) Staff
Practical experience in the student's area of specialization or interest. The student may work with a government agency, congressional committee, court, or other such entity performing tasks normally assigned to an attorney. Course approval must be obtained from the student's faculty adviser and/or the Dean. A maximum of four credit hours may be applied toward graduation. For each credit hour, 56 hours of non-remunerated work must be performed. A written report describing in some detail the specific work performed and evaluating the experience received is required. (Limited to LL.M. candidates.) The grade *CR* (Credit) or *NC* (No Credit) is given for this course. (Fall, spring, summer)

597 **Independent Studies** (arr.) Staff
Limited to teaching fellows. The proposed program of study must be submitted to a faculty member in writing and approved prior to the beginning of the semester. May not be elected for more than 12 semester hours of credit. (Fall and spring)

598 **Research in Public Law** (1 or 2) Staff
Limited to graduate students with at least a *B* average who have had a seminar or comparable course in field of proposed research. Students are responsible for obtaining an adviser from the full-time faculty who is willing to sponsor their research. This adviser's name must be submitted to the Dean at registration. Work must be completed within the semester. Students may repeat this course once for credit with the approval of the Dean. (Research Paper) (Fall, spring, summer)

99–600 **Thesis** (2–2)
Students must register for two successive semesters and cannot register for both sections in one semester. (Fall, spring, summer)

620–21 **Legal Research, Writing, and Professional Responsibility and Ethics** (1–1) Buckhold
(For Foreign Students)
Introduction to and practical experience in the use of a law library; instruction and practice in legal writing, including a memorandum and appellate court brief; instruction and experience in the preparation and argument of an appellate court case; instruction in questions of professional responsibility and ethics. The grade *CR* (Credit) or *NC* (No Credit) is given for this course. For credit, a student must attain a minimum grade of 65. No credit will be given for this course unless it is taken both fall and spring semesters. Failure to complete the work in this course will result in a grade of 45. (Fall and spring—evening)

SPECIAL PROGRAMS IN RESEARCH AND INSTRUCTION

ENVIRONMENTAL AND ENERGY LAW PROGRAM

Director A.W. Reitze

The Environmental and Energy Law Program provides course work for J.D. candidates and a specialty LL.M. program for lawyers. The formal course work provides the most extensive coverage in this field of any law school in the nation. At the present time, ten courses are offered. In addition, there are many related law course offerings, particularly in land use planning, that are available. A clinical program allows students to receive academic credit for internships with government agencies and non-profit environmental litigation groups. Research courses allow students to pursue individual interests under faculty guidance or to participate in faculty research projects.

GOVERNMENT CONTRACTS PROGRAM

Director R.C. Nash, Jr.

A comprehensive government contracts program provides continuing instruction for industry and government personnel in this field and a program of courses leading to the Master of Laws degree in Government Procurement Law. The program includes (1) short seminars, (2) one-week courses in advanced problems in the field, (3) an annual institute treating a problem of contemporary importance, (4) an annual conference in a major area, (5) compilation of materials for use in current courses, (6) publication of a series of monographs treating special problems in the field, and (7) special research projects.

INTERNATIONAL AND COMPARATIVE LAW PROGRAM

Director W.T. Mallison

The objectives of the International and Comparative Law Program are to provide insights, skills, and substantive understanding of international law and foreign legal systems. Specific objectives in international law are to provide an understanding of decision-making, sanction processes, legal institutions, and the relationships between domestic and international law. Specific objectives in comparative law include understanding of the basic institutions of civil law countries, the reception of civil law and common law in non-Western countries, and the role of decisional law and judicial review in selected legal systems. Improvements which are needed to promote the rule of law in the world community are also considered. International aspects of business transactions and economic development are included in the Program. The objectives of the Program are implemented through course work and seminars for both J.D. and post-J.D. degree students and through research and writing in pertinent fields.

AND USE MANAGEMENT AND CONTROL PROGRAM

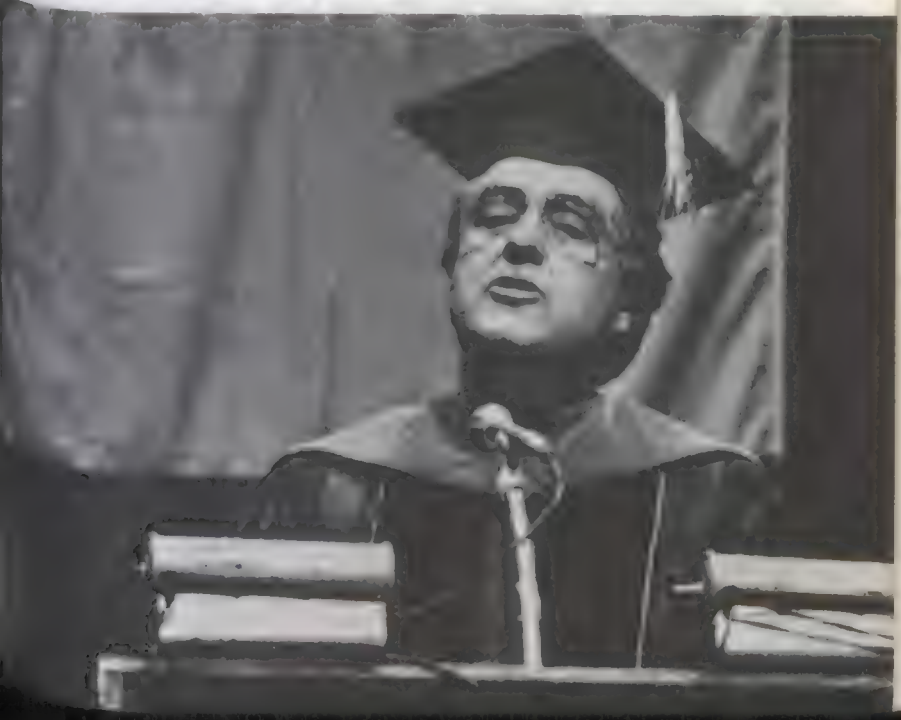
irector J.M. Brown

he social, economic, technological, political, and legal interrelationships gen-ated by the fact that land is a basic, limited-supply natural resource, capable f being subjected to differing but concurrent public and private uses, raise a owing number of issues involving management policy and control measures hich are of critical concern to the future of the nation. The Land Use Man-ement and Control Program, through a combination of academic, clinical, d game-simulation processes, seeks to provide an understanding of existing d pending problems, needs, means, and opportunities for solution with respect this developing area of national concern.

ATENT LAW PROGRAM

irector Irving Kayton

he Patent Law Program is designed for students in the J.D. and Post-J.D. egree programs whose intentions are to specialize in the practice of patent law. uring the past eight years an organized program has been developed to offer complete and as integrated a collection of courses in patent law as possible. he course offerings in patent law now total 17 semester hours, far more than y other law school in the United States. In addition, courses in trademark d copyright law are also available (see the "Patent and Trade Regulation aw" area of specialization in the "Advanced Courses" section of this bulletin r a complete list and detailed description of the patent law courses offered). he object of the Patent Law Program is to provide the student with a concen-tion in patent law at a level of specialization and maturity which will enable dvancement more rapidly in this field.



GENERAL ALUMNI ASSOCIATION

President William M. Porter, M.S. in Adm. 1970

The objectives of this association are to unite the graduates who wish to associate themselves for charitable, educational, literary, and scientific purposes, and to promote the general welfare of the University.

Eligible members are those who have enrolled in any school of the University and who have left the University in good standing, or any person who is or has been a member of the teaching, research, or administrative staff of the University, or of the Board of Trustees of the University.

The affairs of the Association are directed by a Governing Board, the majority of whose members represent the constituent alumni organizations of the University's schools and colleges.

The voluntary leadership of the Association works closely with the staff of the Alumni Relations Office in carrying out Association affairs. The Association may be contacted through the Alumni Relations Office.

THE GEORGE WASHINGTON LAW ASSOCIATION

Director of Law Alumni Relations Clifford A. Dougherty, J.D.(W.H.) 1964

The George Washington Law Association was founded in 1912 and has been affiliated with the General Alumni Association since 1926. Its purposes as stated in the constitution are to promote high standards of legal education, to keep the alumni of the school in close touch with one another, especially with members of their own classes, to gather and publish at intervals information as to the whereabouts and activities of these alumni, and to further the interests of the school.

Eligible members are those who have matriculated in the school or National University and have left in good standing, and any member or former member of the faculty of the school. Active members are those eligible members who are current contributors to the Law Annual Support Program of the University and life members of the George Washington Law Association.

The Association plans publication periodically of the Law Alumni Directory. Law alumni are urged to keep the Alumni Office informed of their whereabouts so that directory information can be kept up to date.

The Law Alumni Office is in the University's Gelman Library, 2130 H Street, N.W., Washington, D.C. 20052.

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THE UNIVERSITY

HISTORY AND ORGANIZATION

The George Washington University had its beginning in 1821 as The Columbian College in the District of Columbia. The name of the institution was changed in 1873 to Columbian University and in 1904 to The George Washington University. The debt of the University to George Washington, whose name it bears, is an intangible one.

George Washington, as President and as private citizen, had urgently insisted upon the establishment of a National University in the Federal City. There he hoped that, while being instructed in the arts and sciences, students from all parts of the country would acquire the habits of good citizenship, throwing off local prejudices and gaining at first hand a knowledge of the practice, as well as the theory, of republican government. To further the materialization of his hopes, Washington left a bequest of fifty shares of The Potomac Company "towards the endowment of a University to be established within the limits of the District of Columbia, under the auspices of the General Government, if that government should incline to extend a fostering hand towards it." The Congress never extended "a fostering hand." The Potomac Company passed out of existence, and Washington's bequest became worthless.

Fully conscious of Washington's hopes, but motivated primarily by a great missionary urge and the need for a learned clergy, a group of dedicated ministers and laymen sponsored a movement for the establishment of a college in the District of Columbia. Inspired largely by the zeal and energy of the Reverend Luther Rice, they raised funds for the purchase of a site and petitioned Congress for a charter. After much delay and amendment, Congress granted a charter which was approved by President Monroe on February 9, 1821. To safeguard the College's nonsectarian character it provided "that persons of every religious denomination shall be capable of being elected Trustees; nor shall any person, either as President, Professor, Tutor or pupil, be refused admittance into said College, or denied any of the privileges, immunities, or advantages thereof, for or on account of his sentiments in matters of religion."

During the entire time when the institution was known as Columbian College, its activities were centered on College Hill, a tract of forty-six and a half acres between the present Fourteenth and Fifteenth Streets extending north from Florida Avenue to somewhat beyond Columbia Road. The Medical School was located downtown. For the better part of the Columbian University period, the buildings of the University were situated along H Street between Thirteenth and Fifteenth Streets.

During the last half century the University's present plant has been developed in that section of the old First Ward familiarly known as "Foggy Bottom," between Nineteenth and Twenty-fourth Streets, south of Pennsylvania Avenue. The area contains several reminders of historic interest to the University. President Monroe, who signed the Charter, lived at 2017 Eye Street. The first President of the Board of Trustees, the Reverend Obadiah B. Brown, was for fifty years the pastor of a church at Nineteenth and Eye Streets, and Washington

lected Twenty-third and E Streets as the site of the National University he d hoped to see established.

The University as it is now organized consists of Columbian College of Arts d Sciences (undergraduate); the Graduate School of Arts and Sciences; the ofessional schools, which include the National Law Center and the schools Medicine and Health Sciences, Engineering and Applied Science, Education, overnment and Business Administration, Public and International Affairs; the llege of General Studies; the Division of University Students; the Summer ssions; and the Division of Experimental Programs.

The George Washington University is privately endowed and is governed by self-perpetuating Board of Trustees of which the president is an ex officio mber.

CADEMIC STATUS

e George Washington University is accredited by its regional accrediting ency, the Middle States Association of Colleges and Secondary Schools. The iversity is on the approved list of the American Association of University men and is a member of the College Entrance Examination Board.

CATION

e University is in downtown Washington, between Pennsylvania Avenue and th, F, and 24th Streets, N.W. In immediately adjacent areas are the White use, the World Bank, the International Communication Agency, the Corco- Gallery of Art, the Department of State, the Department of the Interior, e General Services Administration, the National Academy of Sciences, and Kennedy Center for the Performing Arts.

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	1st year	*2nd year*	*3rd year*	*4th year*	*Graduate*	*Other*
Day	344	345	371	.....	83	3
Evening	112	100	76	59	148	25

Total: 1,666

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OOL OF GOVERNMENT AND BUSINESS ADMINISTRATION: Bachelor of Business ministration (B.B.A.), Master of Accounting (M.Acct.), Master of Business ministration (M.B.A.), Master of Health Services Administration (M.H.S.A.), ster of Public Administration (M.P.A.), Master of Science in Information tems Technology (M.S. in I.S.T.), Master of Urban and Regional Planning U.&R.P.), Post-Master's Graduate Certificate in Health Services Adminis-tion (Grad.Cert. in H.S.A.), Doctor of Business Administration (D.B.A.), and ctor of Public Administration (D.P.A.)

OOL OF PUBLIC AND INTERNATIONAL AFFAIRS: Bachelor of Arts (B.A.) and ster of Arts (M.A.)



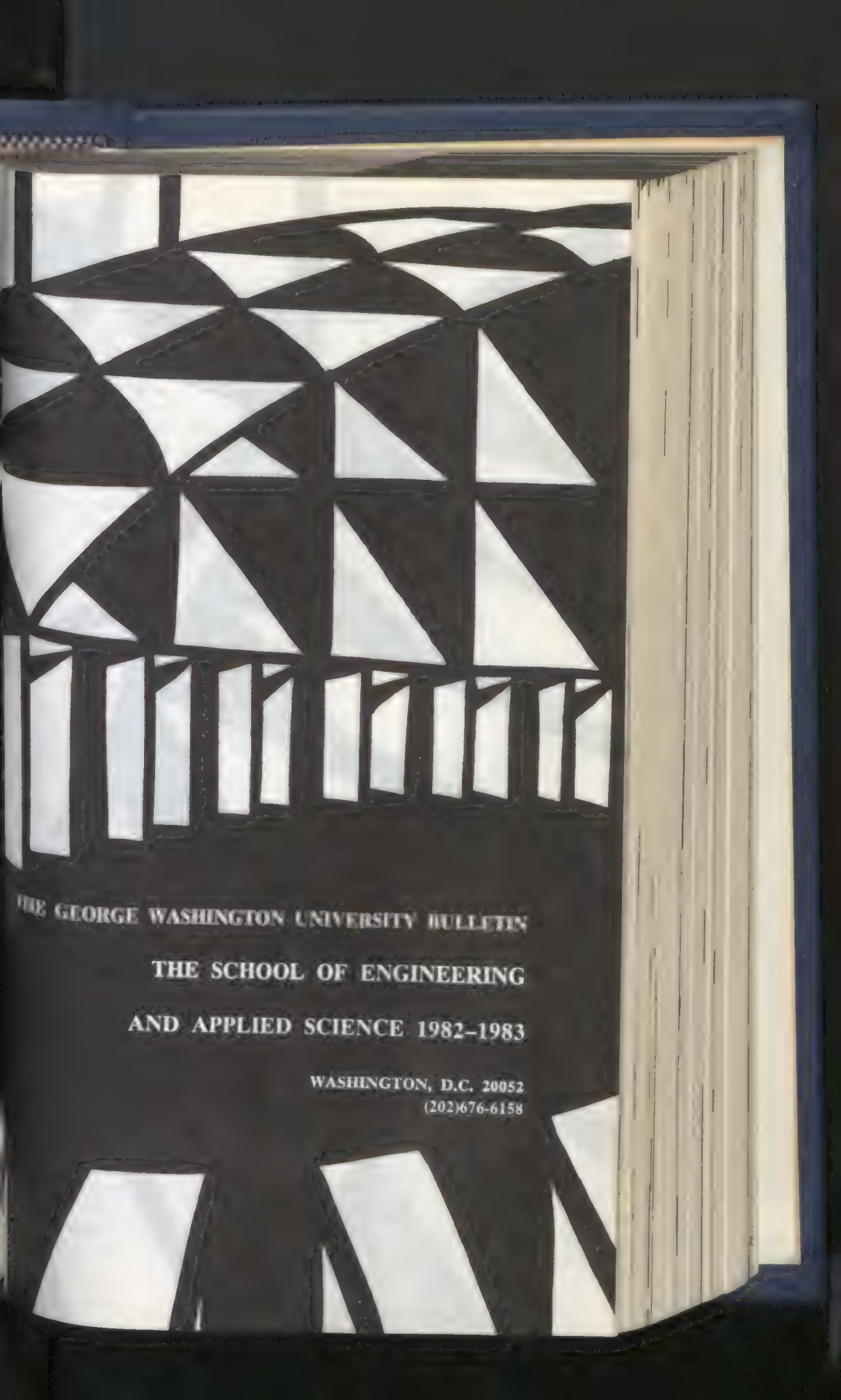

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EORGE WASHINGTON UNIVERSITY BULLETIN
XXXI, No. 2, April 1982
OF ENGINEERING AND APPLIED SCIENCE

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THE GEORGE WASHINGTON UNIVERSITY BULLETIN

THE SCHOOL OF ENGINEERING AND APPLIED SCIENCE 1982–1983

WASHINGTON, D.C. 20052
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THE CALENDAR 1982–1983*

1982	FALL SEMESTER
August 31–September 1	Advising for all students *Tuesday–Wednesday*
September 1	Orientation for new students from foreign countries *Wednesday*
September 2	Orientation and placement tests for all new undergraduate students *Thursday*
†*September 1–3*	Registration—Tompkins Hall of Engineering *Wednesday–Friday*
	Application for February graduation due as part of registration
September 6	Labor Day (holiday) *Monday*
September 7	Classes begin *Tuesday*
November 1	Application for spring semester financial aid due *Monday*
November 22	D.Sc. dissertations of February candidates due *Monday*
November 24	Thanksgiving recess begins after last class *Wednesday*
November 29	Classes resume *Monday*
December 7	Last day of fall semester classes *Tuesday*
December 13–22	Examination period

1983	SPRING SEMESTER
January 7	Master's theses of February candidates due *Friday*
January 10	Orientation for new students from foreign countries *Monday*
January 11–12	Orientation and placement tests for all new undergraduate students *Tuesday–Wednesday*
	Advising for all students
†*January 12–14*	Registration—Tompkins Hall of Engineering *Wednesday–Friday*
	Application for May graduation due as part of registration
January 17	Spring semester classes begin *Monday*
February 7	Deadline for submission of 1983–84 freshman student financial aid applications *Monday*
February 21	Winter Convocation (holiday) *Monday*
March 1	Deadline for submission of 1983–84 continuing and transfer undergraduate student financial aid applications *Tuesday*
March 7	D.Sc. dissertations of May candidates due *Monday*
March 12	Spring recess begins after last class *Saturday*
March 21	Classes resume *Monday*
April 1	Deadline for submission of Summer Sessions and 1983–84 graduate financial aid applications *Friday*
April 18	Master's theses of May candidates due *Monday*
April 22	Last day of spring semester classes *Friday*
April 28–May 7	Examination period
May 8	Commencement *Sunday*

*This calendar is subject to change.
†The registration procedure and hours of registration will be stated in the *Schedule of Classes* which is available well in advance of each semester.

1982

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TO ALL PROSPECTIVE STUDENTS:

The School of Engineering and Applied Science has been in continuous session since 1884, and offers programs of study leading to Bachelor's, Master's, Professional, and Doctor's degrees. Its prime objective is to develop in the student the precious asset of a well-trained mind which may be applied to the attainment of our many national objectives. In these changing times, it is necessary to search for quality. Students and faculty have the opportunity of assisting in the planning and implementation of educational programs. Examination is made periodically of the School's objectives and how they relate to those established by the Accreditation Board for Engineering and Technology (ABET). Emphasis includes such items as the student's basic and advanced levels of education and role in present and future society.

This catalogue describes the programs and requirements for undergraduate and graduate study in the School of Engineering and Applied Science and includes information on the Engineering Honors Scholarships, Cooperative Education Program in Engineering, and the Joint Institute for Advancement of Flight Sciences (JIAFS).

The program of Engineering Honors Scholarships has been established to recognize academically talented students who wish to study at the School of Engineering and Applied Science. The scholarships are awarded on the basis of academic merit only and financial need is not a requirement for consideration.

The Cooperative Education Program in Engineering provides the undergraduate engineering student with the opportunity to obtain an enduring foundation in engineering education by combining academic learning with practical, first-hand experience in the student's chosen field of engineering. The student's earnings will help to pay for a major part of the cost of an engineering education.

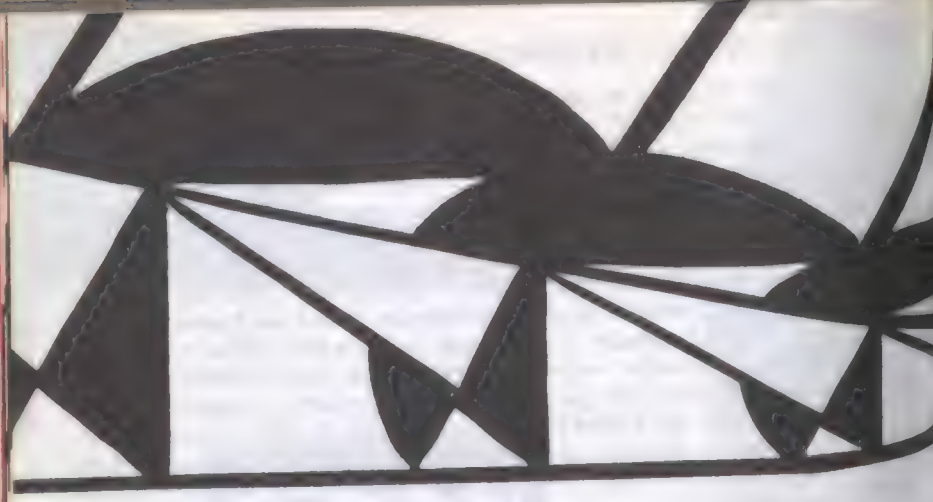
JIAFS was created by the joint efforts of the NASA-Langley Research Center and the School of Engineering and Applied Science. The education and research opportunities offered in the program combine the academic resources of George Washington University and the professional research resources and facilities of NASA-Langley Research Center to prepare qualified graduate students for careers in research, development, design, and teaching.

The School of Engineering and Applied Science is a professional school in the University comprised of eight degree-granting schools and colleges. The environment of the nation's capital is very favorable for the intellectual and cultural development of the student. The metropolitan Washington area contains the second largest concentration of research and development in the United States, and the engineering component of this activity is similarly extensive, offering many employment opportunities to students after graduation. The atmosphere of the School is one of serious-minded effort toward mature development. Being a small school, it recognizes the individual as the single most important element in the educational process. The student body, undergraduate and graduate, has a primary interest in design, research, development, and management in both scientific and engineering activities. Many alumni of the School are successfully engaged in all fields of engineering—in science, management, government, and education.

The philosophy of the School, which might be summarized as "education for creativity, not conformity," has through the years reflected the many subtle and profound changes in the engineering profession.

The faculty of the School and I look forward to a closer and more fruitful relationship with you. If you need additional information, please do not hesitate to call upon the department chairmen or me.

HAROLD LIEBOWITZ
Dean



THE STUDY OF ENGINEERING

The Meaning of Engineering and Applied Science

The responsibilities and activities of the engineering profession extend into every aspect of industry and research and into many fields of commerce and the arts. Engineers face problems in the production and distribution of all types of manufactured products, including the design of mechanical, electrical, and chemical processes, of equipment, and of plants in which such products are made; in the design and construction of a variety of structures such as bridges, tunnels, harbors, and dams; in aircraft design and construction, including complicated electronic equipment for control, guidance, and communication; in the operation of transportation systems; in the automotive industry; in the missile and space programs; in energy resources and power and in the generation and transmission of power; in modern communication; in traffic control; in city planning; in public health and sanitation as it affects the environment; and in ventilation and refrigeration. This list of applications is far from exhaustive; it does indicate, however, that engineering is a broad profession in which there are many opportunities to specialize.

The Relationship of Engineering and Science

In any discussion of engineering and applied science, it is important to emphasize the distinction between engineering and science. The President's Scientific Advisory Committee points out that the engineer and scientist each play an important role on a team: "The scientist is one who seeks to extend the boundaries of knowledge in his chosen field. The engineer has the task of combining the knowledge of science with a knowledge and awareness of the needs and limitations of human beings and of a human society to develop and create things for human use. . . . While scientists have uncovered the basic knowledge, it is the engineers who have created the tangible tools, materials, and products that have revolutionized our daily lives, our community living, and our national defense."

The work of engineers is a focal point at which scientific knowledge, the use of such knowledge as a service to society, financial considerations, human resources, and society's needs are interrelated. The engineer is concerned, therefore, with the means for operating a dynamic society, and must consider not only whether the knowledge that exists will enable the creation of a workable product, but also how the product can be built, who will use it, and how such use will affect the environment in which it will operate.

The Professional Engineer

Engineers are concerned with the quality and preservation of human life. Engineer, as the term is used in this Bulletin and as it is commonly understood in our society, refers to the person who makes use of the advances of science and technology in an economically feasible manner for the benefit of society. This process is complex and challenging. Although the content of engineering curricula is certainly scientific, the engineer has not lost a sense of purpose in serving as an intellectual agent in the practical world. This responsibility of the engineer arises from the breadth of the implications of engineering for the whole of society as well as from the depth of the requirements for competence. Technology has radically rearranged human life in our time. There are many who believe that, although the threshold of space has been crossed, the age of medical and engineering practice has been achieved, and breakthroughs have been made in other areas, this impact of engineering on modern life is just a modest preview of the engineering of tomorrow.

Engineering Education and the Student

The rapidly changing and progressing engineering activity requires an education for the future based on fundamental principles of science useful in applications in a dynamic, advanced society. In the fields of engineering and applied science there is no substitute for demonstrated ability and competence to solve the problems faced. Without question, achievement in particular courses of study is important. Equally important, however, is the ability to analyze and interpret all the aspects of a problem, to formulate solutions, and to evaluate those solutions in the light of all available information. To assure that the undergraduate education will enable students to meet these important goals, the faculty of the School of Engineering and Applied Science periodically evaluates and appraises the undergraduate program.

The curricula of the School of Engineering and Applied Science are founded on the basic principle of assisting the student in preparing for a career in engineering and applied science. This philosophy requires that the student master the principles on which future practice will be based. An education centered on that meaningful junction between theory and practice enables the engineer to follow the many interests and opportunities that may develop.

It should not be assumed, however, that only the intellectual elite should consider the study of engineering and applied science. Engineering, like medicine, law, education, science, history, government, and other disciplines, requires scholars. But in any of these areas the prospective student who has not

achieved high scholastic standing can find a place, if the student has genuine interest in the subject. The average student who is interested and willing to work will find in engineering and applied science a rich and varied field of study which can lead to satisfaction and success. It is difficult to make generalizations in this area, but students who have demonstrated an aptitude for mathematics, science, and English will probably find the work of engineers and the study of engineering and applied science satisfying and challenging. Innate intellectual curiosity and the desire to learn and to work hard are good indicators of success. College Board examinations may reveal the capacity to undertake further study in mathematics and science and their applications to engineering. No school or college can "give" an education. It can offer only the opportunity to "get" an education. The George Washington University's School of Engineering and Applied Science provides an opportunity for close contact with faculty members, as well as the opportunity to participate in student organizations and in many other student activities. The School recognizes the individual as the most important element in the educational process.



THE SCHOOL OF ENGINEERING AND APPLIED SCIENCE

History

The School of Engineering and Applied Science was organized October 1, 1884, as the Corcoran Scientific School of Columbian University and was situated in the University Building then at 15th and H Streets, N.W. The School was named in honor of William W. Corcoran, Trustee and President of the Corporation from 1869 to 1888. Day and evening courses were offered in literature, science, and technology and led to the degrees of Bachelor of Science, Civil Engineer, Mechanical Engineer, and Mining Engineer. The School was among the first to accept women for degree candidacy in engineering.

In 1903 the Corcoran Scientific School, the School of Graduate Studies, and the Columbian College were merged into a single Department of Arts and Sciences. Graduate engineering degrees were offered.

Administrative changes led to The Washington College of Engineering being created in 1905 as one of the several semi-independent undergraduate colleges of the University, each with its own Board of Trustees. The College provided instruction leading to undergraduate degrees in engineering and architecture.

In 1909 the name of the College was changed to the College of Engineering and Mechanic Arts, and the curricula were revised to give the student a thorough understanding of the theory underlying engineering practice. Emphasis was placed on the development of a knowledge of scientific principles upon which the student could build and by which he might solve new problems as they are met in practice.

The name of the School was changed again in 1914 to the College of Engineering and later to the School of Engineering. Architecture was dropped from the curriculum, and degrees were limited to the field of engineering. However, the primary emphasis upon principles rather than technology which had characterized the School since 1903 was continued and has remained to this day as one of the important distinguishing features of the School.

In 1962 the name of the School became the School of Engineering and Applied Science.

Academic Status

The George Washington University is accredited by its regional accrediting agency, the Middle States Association of Colleges and Secondary Schools.

The University is on the approved list of the American Association of University Women and is a member of the College Entrance Examination Board.

The undergraduate curricula in Civil Engineering, Electrical Engineering, and Mechanical Engineering are accredited by the Accreditation Board for Engineering and Technology (formerly the Engineers' Council for Professional Development).

University Policy on Equal Opportunity

George Washington University does not discriminate against any person on the basis of race, color, religion, sex, national origin, age, handicap, or veteran status. This policy covers all programs, services, policies, and procedures of the University, including admission to educational programs and employment. The University is subject to the District of Columbia Human Rights Law.

Inquiries concerning the application of this policy and federal laws and regulations concerning discrimination in education or employment programs and activities may be addressed to Dr. Marianne Phelps, Assistant Provost for Affirmative Action, George Washington University, Rice Hall, Washington, D.C. 20052, or to the Assistant Secretary for Civil Rights of the Department of Education.

Undergraduate Study

The undergraduate program is intended to provide a solid foundation in the basic principles, concepts, and techniques underlying engineering and applied science, on which the individual may build technical competence in a variety of areas as his professional career develops. It is preparation for a career in engineering or applied science, as it exists today and as it may develop in the future.

Undergraduate study is the formal beginning of a lifelong continuing program of education. The School provides an environment that fosters the attitudes and disciplines essential to professional growth. Graduates, when they receive the bachelor's degree, are prepared for productive work in the chosen field and for further development and progress, both formal and informal. The undergraduate curricula include courses in the humanities and social sciences to the extent necessary to develop a reasonable understanding and appreciation of these areas of knowledge.

Admission to the engineering program indicates that the student possesses the required preparation and the probable capacity to meet the academic demands of this School. Since the School cannot predict either the student's response to the academic demands or the program to follow for the most effective development, the undergraduate program has been designed to offer a variety of experiences through which the student may find the best path to educational growth and maturity.

The School is a place for learning; for experiencing adventures of the mind and of the hands; for the formulation, exchange, and exploration of ideas. During the undergraduate years the student is led to strengthen skills in analysis and talent for creative activity, through liberal use of project-type laboratory work. Independent thought and original ideas receive higher evaluation, in the appraisal of student achievements, than the rote recital of information.

To provide the undergraduate engineering student with the opportunity to obtain an enduring foundation in engineering education by combining academic learning with relevant, real-world employment which provides practical, first-hand experience in engineering, the School of Engineering and Applied Science has an optional Cooperative Education Program in Engineering in which arrangements have been made with leading industrial and governmental organizations for student employment at prevailing salary rates. Every effort is made to place the student in positions of employment that provide the best possible engineering experience consistent with career plans. These work periods provide the student with income that may be used to finance the major portion of tuition and other expenses. Entering freshmen, as well as transfer students whose completed work is equivalent to requirements in this program, can be admitted to the Cooperative Education Program in Engineering.

ADMISSION TO UNDERGRADUATE STUDY

The School admits those applicants who can benefit themselves and society by disciplined intellectual effort in its environment.

Admission is the first selective step in a long series of qualifying steps the student will take in his progress toward professional competence in engineering. It indicates the School's belief that the applicant has at least the minimum preparation and ability to complete the curriculum successfully.

The applicant must be of good character and must have an academic background appropriate for the program of studies contemplated.

Application for Admission

The applicant for admission obtains from the Office of Admissions of the University or from the School of Engineering and Applied Science an application book which must be filled out completely and returned with the $20* application fee.

Students From U.S. Institutions

Credentials presented become the property of the University and *cannot* be returned.

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*Application fee must be by check or postal money order, payable to George Washington University. The application fee is waived for a student applying for readmission who was registered in the same program at the time of the student's last registration at this University and who has not since registered at another institution.

INCOMING FRESHMEN

Consideration for admission is based on the following: (1) an acceptable certificate of graduation from an accredited high school showing at least 15 units*; (2) scores on the College Entrance Examination Board's Scholastic Aptitude Test (SAT), or on the American College Test (ACT); (3) high school grades; (4) class standing.

The principal's statement that the applicant is prepared to undertake college work may also be requested by the University.

Nine and one-half of the 15 units required for entrance must be distributed as follows: three in English, two in algebra, one in plane geometry, one-half in plane trigonometry, one in physics or chemistry, and two in history or a foreign language or both. General science may *not* be counted in satisfaction of the science requirement but may be counted as an elective unit. It is recommended that *both* physics and chemistry be studied in high school.

The qualifications of applicants who, because of unusual circumstances, do not meet the above requirements will be considered by the School, which may prescribe admission tests in mathematics or English or both.

An applicant must arrange to have sent directly *from his school to the Office of Admissions of the University* the secondary school academic record. This information must be stated on a standard form used by the secondary school, and all essential information must be included.

Quantitative Deficiency—A graduate of an approved high school who lacks not more than two units of the required subjects and who presents 15 acceptable units may be admitted to a prescribed program which includes courses to make up the deficiencies.

Applicants who wish to begin study in the fall semester should formulate plans early in the high school senior year. Although the University prefers to have applications submitted during the fall semester of the high school senior year, applications may be submitted until August 1. However, students wishing to be considered for financial aid or on-campus housing should have their applications and all required documents submitted by February 1. Students graduating at mid-term wishing to begin study in the spring semester *should* have their applications, transcripts, and other required documents submitted no later than December 15. Applications and all required credentials of students wishing to begin study in either the first or second term of the summer session must be received prior to April 15. Applications for the third summer session should be received by June 15.

Although decisions on some applications for the fall semester will require submission of seventh-term grades and senior-year College Board test scores, an earlier decision may be given after September 1 to a student whose application comes complete with a secondary school record through the junior year and junior-year test scores, provided these records clearly establish academic admissibility.

TRANSFER STUDENTS

Transfer students from other institutions (see page 24 for minimum residence requirement) should submit all applications and required credentials prior to

* A unit represents a year's study in a secondary school subject, including in the aggregate not less than 120 sixty-minute periods of prepared classroom work.

August 1 for the fall semester, December 1 for the spring semester, April 1 for the summer sessions.

The transfer student must be in good standing as to scholarship and conduct. A student who has been suspended more than one time, has been academically dismissed, or is currently on probation or suspension from another academic institution will not normally be considered for admission.

An applicant who has attended one or more institutions of higher learning must request *each registrar* to mail directly *to the Office of Admissions of the University* a transcript of his or her record, *even if credits were not earned.*

If an applicant has fewer than 30 semester hours of acceptable college work (C or better in academic courses from an accredited institution), at the time the application is submitted, the applicant must request that the high school record and College Examination Board SAT or ACT test scores be sent to the Office of Admissions.

Students from Foreign Institutions

REQUIRED RECORDS

At the time the application is sent, the applicant must request the educational institution previously attended to send directly to the Office of Admissions copies of official certificates and records listing subjects studied, grades received, examinations taken, and degrees received. Certified copies of diplomas and certificates from all secondary schools, colleges, and universities attended are required. Records of state examinations and certificates are also required. These records become the property of the University and cannot be returned. These documents should be in the language in which the institution keeps its official records. If they are in a language other than English, the copies which are sent should be accompanied by an English translation completed by an independent agency.

Consideration will be given to academic documents delivered by the student if circumstances prohibit the receipt of official records.

LANGUAGE TEST

Students whose native tongue is not English are *not required* to take the TOEFL test (Test of English as a Foreign Language) or the ALIGU* test (American Language Institute, Georgetown University). However, they are encouraged to do so. Students receiving a grade of 550 or higher on the TOEFL or 85 in the ALIGU will not be required to take the University's English placement test or enroll in the English as a Foreign Language program. Foreign students abroad should consult with the nearest U.S. Embassy for information on arrangements for taking ALIGU. Those interested in TOEFL should address inquiries to TOEFL, Educational Testing Service, Princeton, New Jersey 08540, U.S.A., well in advance of the beginning of the semester for which admission is sought. The test fee remitted with the application entitles the student to have the test scores sent to three different institutions. Registration for either the TOEFL or the ALIGU test does not constitute application for admission to George Washington University.

The TOEFL *Bulletin of Information*, obtainable without charge, contains a description of the test as well as rules regarding application, fees, reports, and

*ALIGU tests are sometimes given overseas at U.S. Embassies.

the conduct of the test, lists of examination centers, examination dates, and an application blank. On the application for the Test, the student should specify that the scores be sent to the appropriate admissions office at this University (see "Admission to Undergraduate Study," page 13. or "Graduate Admission Procedure," page 28).

An admitted student may be required to take a test in English as a Second Language, administered by the George Washington Unviersity, prior to registration. Results of this test will determine level of English instruction (see "Special English Courses for International Students," below) or other courses the student will be permitted to register for in the program of study. If the knowledge of English is inadequate to enable the student to undertake the normal academic load, the student will not be permitted to register for any courses other than English (or English plus a reduced technical load) and will be required to study English on a full-time basis. Students in this category should therefore expect to take a longer period of time to complete their graduation requirements than students who are not obliged to complete the additional English courses.

International students already in the United States may take a locally administered George Washington University English placement test in lieu of the ALIGU or TOEFL test. A $10 fee is charged for this examination. Because this test is not given on a regularly scheduled basis, arrangements should be made by contacting:

Dr. Shirley M. Wright, Director
English for International Students
George Washington University
Washington, D.C. 20052
(202) 676-7136

FINANCIAL CERTIFICATE

If a student plans to enter or remain in the United States to study at this University and the visa status will be either student (F) or exchange visitor (J), a Form I-20 or DSP-66 cannot be issued until the student has been admitted to the University and has completed a George Washington University Financial Certificate satisfactorily. The Financial Certificate (Form 212), required by the Office of Immigration and Naturalization, is a document that may be obtained from the School of Engineering and Applied Science. It requests information about the resources (money) available to the student to support his/her educational and living expenses while in the United States. The Certificate should be accompanied by supporting documents such as bank statements or letters from governments authorizing scholarship awards.

SPECIAL ENGLISH COURSES FOR INTERNATIONAL STUDENTS

The extensive experience of the Department of English with the language needs of international students has been synthesized into a comprehensive English Language Program that includes the following courses:

ENGLISH AS A FOREIGN LANGUAGE

15 Intensive Basic English (0)
Introduction of basic grammatical structure through oral drill and practice and of basic practical vocabulary. Course meets fifteen class hours

and five monitored laboratory hours per week. Students registered in EFL 15 will not be permitted to register for any other academic course. Tuition is charged at the rate of eight semester hours; laboratory fee, $35.

20 Intensive Lower-Intermediate English (0)

(Formerly Intensive Basic English)

Continued basic grammar, reading, and vocabulary development; emphasis on oral skills. Course meets fifteen class hours and five monitored laboratory hours per week. Students registered in EFL 20 will not be permitted to register for any other academic course. Tuition is charged at the rate of eight semester hours; laboratory fee, $35.

30 Intensive Intermediate English (0)

(Formerly Intensive Lower-Intermediate English)

Introduction of complex grammatical structures, intensive reading, paragraph-level writing, and further vocabulary development and oral practice. Course meets fifteen class hours and five monitored laboratory hours per week. Students registered in EFL 30 will not be permitted to take additional academic work unless approved by the adviser. Tuition is charged at the rate of eight semester hours; laboratory fee, $35.

40 Intensive Higher-Intermediate English (0)

Comprehensive review of grammatical structures, enlargement of vocabulary through use of unadapted and technical reading material; development of effective reading strategies; composition focusing on outlining and techniques of exposition. Twenty hours per week. Students registered in EFL 40 will not be permitted to take additional academic work unless approved by the adviser. Tuition is charged at the rate of eight semester hours.

45 Semi-Intensive Higher-Intermediate English (0)

Practice in composition writing; selective review of problematic grammatical structures, introduction to research techniques; development of reading and speaking skills and expansion of vocabulary through use of unadapted reading materials. Ten class hours per week. Students registered in EFL 45 should register for a maximum of two other academic courses. Tuition is charged at the rate of five semester hours.

50 English Composition/Research Methods for International Students (3)

An advanced-level composition course for international students showing a high degree of academic proficiency in English. Four class hours per week. This course can be taken by international students in lieu of Engl 9 or 10. Students registered in EFL 50 should register for a full academic load. Special fee, $25.

60 Advanced Conversation (0)

An advanced-level conversation course for international students who show a high degree of academic proficiency in English. Development and practice of conversational skills using contemporary topics from newspaper and magazine articles, films, interviews, and guest lectures. Five class hours per week. Tuition is charged at the rate of three semester hours; special fee, $25.

The language laboratory is available to all students in the English Language ...gram. The laboratory contains a library of tapes that accompany the printed ...ts and a variety of listening and recording equipment, including individual ...ording and playback equipment.

Admission to a particular English class is determined by a suitable series of ...ective and nonobjective tests.

The English Language Program is administered by the Division of Continuing Education and Summer Sessions and is offered in cooperation with the Department of English, Professor J.P. Reesing, Jr., Chairman. Dr. Shirley M. Wright is the Director of the English for International Students Program.

Readmission

A student previously registered in the University who was not registered on campus during the immediately preceding semester (summer session excluded) must apply for readmission. Final dates for applying are the same as those for undergraduate admission (see pages 14–15), or graduate admission (see page 28). If the student applies as a degree candidate and was previously registered as a nondegree student, or if a student has attended one or more higher institutions while absent from the University, the student must have complete, official transcripts sent to the appropriate office at this University from each institution attended. Applications for readmission are considered on the basis of regulations currently in effect.

The application fee is waived for a student applying for readmission who was a degree candidate at the time the student last registered at this University and who has not since registered at another institution.

Advanced Standing

CREDIT BY EXAMINATION

Assuming there is no duplication of course work earned, a maximum of 30 semester hours of credit may be assigned toward partial fulfillment of the engineering curriculum upon admission to the University for each or any combination of the following:

College Entrance Examination Board Advanced Placement Tests (APT)—Credit is assigned for examinations passed with scores of 4 or 5 on the basis of a score report sent to the Office of Admissions from the Educational Testing Service at the student's request. The Advanced Placement Tests are administered in the secondary school in May of each year. Normally only students who complete a course designated as Advanced Placement are prepared for the examination. Arrangements for the examination are the responsibility of the applicant and should be made through the secondary school attended or with the Program Director, College Entrance Examination Board, Advanced Placement Tests, Box 592, Princeton, N.J. 08540, or Box 1025, Berkeley, Calif. 94701.

College Entrance Examination Board College-Level Examination Program (CLEP)—CLEP offers two types of examinations: general and subject. CLEP General Examinations are offered in five areas: mathematics, social sciences, humanities, natural sciences, and English composition. CLEP Subject Examinations measure achievement in specific college-level courses and are offered in more than 47 subjects.

New Students—Upon admission to degree candidacy in the School of Engineering and Applied Science, students may be assigned undergraduate credit for the General Examinations in the social sciences (six credit hours) and humanities (six credit hours) passed at the 50th percentile or above (college sophomore norms); such credit is assigned in partial fulfillment of the 18 cred-

hours required in the humanities and social sciences. Credit is not assigned against the engineering curriculum for CLEP General Examinations passed in the areas of mathematics, natural sciences, or English composition.

Credit is assigned for the CLEP Subject Examinations which are applicable to the School's curricula and which are passed at the level recommended in the College Board model policy.

Registered Students—A candidate for a degree (*i.e.*, a student already registered at the University before taking the CLEP Examinations) must seek departmental approval prior to taking the CLEP Examination for credit. Credit may not be earned by passing the Examination after having taken the equivalent course or after having taken a waiver examination for the course.

Arrangements for the Examinations are the responsibility of the applicant and should be made with the College Entrance Examination Board College-Level Examination Program, Box 1824, Princeton, New Jersey 08540.

Department Examinations for Waiver or Credit—Registered SEAS students may also take examinations in some departments for waiver of, or credit for, specific course (see Fees, p. 212) upon approval of the appropriate department chairman; before the test is administered, the student must have demonstrated sufficient preparation to warrant being given the test. An examination for credit is not allowed if an examination for waiver has been successfully completed or if the student has taken the course.

MAKEUP OF CREDIT FOR WAIVED COURSES

a course required by the engineering curriculum is waived, the corresponding credit hours must be earned by satisfactory completion of a university-level course, either technical or non-technical, which is approved by the student's faculty adviser or Department Chairman.

WAIVER OF THE ENGLISH COURSE REQUIREMENT

A waiver of the English course requirement in the core curriculum will be granted to those who achieve a score of 650 or higher on the English Composition Achievement Test of the College Entrance Examination Board or a score of 5 or higher on the Test of Written Standard English (TWSE) portion of the TOEFL.

CREDIT FROM INSTITUTIONS OF HIGHER LEARNING

Where there is no duplication involved either through course work or examination, advanced standing may be granted for work successfully completed at accredited institutions of higher learning. Credit will be granted only when such work meets the requirements for the degree sought at this University. Work of low caliber (*D*, or the equivalent, or lower) will not be considered for transfer.

Although there is no strict limit to the total amount of transfer credit that may be assigned, a student must satisfy the residence and course requirements for the degree sought at George Washington University. Students should complete a "Transfer of Credit" worksheet, available in the SEAS Admissions

Office, indicating their request for transfer credit and present the worksheet to their adviser for final approval.

CREDIT FROM SERVICE SCHOOLS

A limited amount of credit may be assigned for selected service school instruction received since 1941. No more than 30 semester hours may be assigned for a combination of service schools and examinations referred to above. Veterans should submit to the Office of Admissions photostatic copies of their service school records, indicating courses successfully completed with sufficient identification of the course to locate it in the *Guide to Evaluation of Educational Experience in the Armed Forces*, which is used as a reference in determining transfer credit.

CREDIT FROM BALTIMORE POLYTECHNIC INSTITUTE

Credit will be assigned to Baltimore Polytechnic Institute "A" course graduates who have earned scores of 80 or above in the applicable courses equivalent to the following engineering core curriculum courses: Math 31, 32; Phys 3, 15; Chem 13; Eng 4; EE 51.

REGULATIONS

Regulations regarding REGISTRATION, FEES, AND FINANCES *are stated on pages 210–15; other University regulations, on pages 221–25.*

Attendance

Students may not attend classes until registration is completed and fees due are paid or appropriate arrangements are made with the Office of Student Accounts. Students may attend only those classes for which they are registered. Regular attendance is required. Students may be dropped from any course for undue absence.

Students are expected to attend every meeting of the courses in which they are registered, fully prepared to carry on the work required. Students are held responsible for all work in their courses, including work missed because of absence. Excuses for absences from examinations which have been announced in advance can be obtained only by written application to the instructor in charge of the course.

Academic Work Load

A full-time undergraduate student who is not on probation may register for no more than 21 semester hours. A student employed more than 24 hours a week who is not on probation may take no more than 10 semester hours. In exceptional cases these limits may be exceeded with the adviser's permission. Students on probation may not register for more than 12 semester hours during the period of their probation.

Advisory System

The School of Engineering and Applied Science encourages a close faculty-student relationship. Every entering undergraduate student is assigned a permanent faculty adviser to assist in orientation in the professional discipline. Faculty advisers counsel students on their programs of study, the achievement and maintenance of satisfactory scholastic performances, professional development, and extracurricular activity as part of the educational process. The adviser represents the student in all cases requiring faculty action.

Students must obtain their advisers' approval of programs of study prior to registration for each academic semester and summer session. Until the work required for the degree is completed, students must consult with their adviser in all academic matters. However, an adviser may not deny entry into any course or activity to which the student is entitled under the regulations of the School.

All students are encouraged to discuss college problems with their advisers or instructors at any time, and parents or guardians are invited to consult with the Dean, Associate Dean, Department Chairman, and adviser concerning any student problems.

For the guidance of the student and the adviser, beginning freshmen who have not waived English Composition 9 or 10 through their English Composition Achievement Test scores or the TWSE (see page 19) or who have not received credit for a college-level calculus course must take the placement examinations in English and mathematics. A student who is deficient in mathematics may be required to take remedial work. Results on the English placement test determine the level of the English course the student will take.

Faculty advisers counsel students to the best of the advisers' professional knowledge, but the final reponsibility for a student's action lies with the student.

Scholarship

For scholarship requirements for graduation, see "Graduation Requirements," pages 24–25.

Grades—Grades are mailed to the student through the Office of the Registrar at the close of each semester. They are not given out by instructors.

The following grading system is used: *A*, Excellent; *B*, Good; *C*, Satisfactory; *D*, Low Pass; *F*, Fail; *I*, Incomplete; *IP*, Progress; *W*, Authorized Withdrawal; Z, Failure, Unauthorized Withdrawal, or Failure to Take the Final Examination. The symbol *I* indicates that a satisfactory explanation has been given the instructor for the student's inability to complete the required work in the course.

SEAS students may not take courses required for graduation on the pass/fail grading system. They may, however, take courses outside their regular engineering academic program under this grading system.

At the option of the instructor, the grade of *I* may be recorded if a student, for reasons beyond his control, is unable to complete the work of the course, and the instructor is informed of and approves such reasons before the date when grades must be reported. The grade may be used only if the student's prior performance and class attendance in the course have been satisfactory. Any failure to complete the work of a course which is not satisfactorily explained to the in-

structor before the date when grades must be turned in will be graded *F*. If acceptable reasons are later presented to the instructor, that instructor may initiate an appropriate grade change. Although the grade of *I may* remain on the records for a maximum of one year, the instructor should normally set a much briefer period within which the uncompleted work (usually the final examination or required paper) must be made up. The grade of *I* cannot be removed by the student's reregistering for the course here or taking its equivalent elsewhere. A grade of *I* that is not removed after one calendar year will be changed on the permanent record to a grade of *F*. A course in which a student receives an *F* in this way must normally be repeated. The grade to which the *I* is changed will be applied to the grade report for the semester or summer session during which the change is made for the purposes of determining probation, suspension, quality-point index, and so forth.

All grades received by a student at George Washington University, regardless of his/her status (i.e., degree, nondegree, or College Program for Secondary School Students), will count in the SEAS quality-point index if the courses are part of the SEAS curriculum.

Humanities, Social Science, Technical Elective, and Graduate-level Course Grades—Courses taken in excess of the number required to fulfill the social science/technical elective requirements (including graduate-level courses) are not included in determining probation/suspension/graduation/Dean's List status. Only those courses initially taken to meet the requirements will be included in computing the requirements of these categories.

Quality-point Index—Scholarship is stated in terms of the quality-point index. The index is obtained by dividing the student's total number of quality points by the total number of semester hours for which the student registered.

Quality points are computed from grades as follows: Each grade is assigned a numerical equivalent: *A*, 4.00 points; *B*, 3.00 points; *C*, 2.00 points; *D*, 1.00 points; *F*, no points. The quality points for a course are obtained by multiplying the credit hours of the course by the numerical equivalent of the grade achieved. Courses marked *W* or *I* are not considered in determining the index. Courses marked *I* will be included in the quality-point index once the *I* is converted to a regular letter grade. This grade will be included in the quality-point index for the semester in which the grade is assigned. Grades in courses taken at other institutions are not considered in computing the quality-point index, with the exception of courses taken at one of the Consortium universities (see pages 211 and 225).

Grades of I *or* P NP—If a grade of *I* is not changed to a letter grade of *A, B, C, D, F,* or *Z* within 30 days, then decisions on probation, removal from probation, suspension, Dean's List, and graduation will be made with the information on hand, in conformance with SEAS regulations, excluding the *I* grade(s).

Students whose status of probation or suspension depends on a grade of *P* are given 30 days to have the grade changed. If not changed by the end of that period, the *P* will be considered a *C* for probation/suspension/graduation/Dean's List purposes, and a grade of *NP* will be considered an *F*. Students may not be considered for the Dean's List with a *P* in their record for the semester in which the *P* was received.

Mid-semester Warning—At the end of the seventh week of each semester, instructors normally report to the Dean the names of students whose scholar-

ship is unsatisfactory. On receipt of a warning notice, students must consult with the appropriate instructor and their adviser immediately. The adviser may prescribe diagnostic tests and/or remedial study to be completed before the end of the current semester.

Probation—A full-time student (one taking 12 semester hours or more) will be placed on probation if his quality-point index is less than 2.0 for one semester or if he receives two or more grades of *F* in one semester or summer session. A part-time student (one taking fewer than 12 semester hours) will be placed on probation if his quality-point index is less than 2.0, or he has received two or more grades of *F*, when he has accumulated 12 semester hours over more than one semester or summer session. For academic purposes, a new grading period will begin once this accumulation is reached.

Removal from Probation—A full-time student will be removed from probation when his quality-point index is 2.0 or more and he receives no grade of *F* in the semester after he is placed on probation. A part-time student will be removed from probation when his quality-point index is 2.0 or more and he receives no grade of *F* for the next 12 semester hours after he is placed on probation.

Suspension—The following cases constitute grounds for suspension: (1) receipt of two grades of *F* or *Z*, or both, any time during a probation period (part-time students receiving two grades of *F* or *Z*, or both, while on probation will be suspended at the time of receipt of the second of these grades); (2) placement on probation in two consecutive semesters (or the equivalent for part-time students); (3) receipt of four grades of *F* in any semester (or the equivalent for part-time students); (4) placement on probation for a third time, whether or not the probation periods are consecutive; (5) accumulation of a quality-point index of (a) 1.5 or less at the end of the sophomore year or upon completion of the 63rd credit in the student's curriculum, (b) 1.9 or less at the end of the junior year or upon completion of the 97th credit in the student's curriculum, or (c) 2.0 or less at any time during the senior year.

Department faculty may designate additional courses to be taken and grades to be received by students who fail to meet but come close to meeting the graduation requirements. Suspension may be held in abeyance until the conditions are or are not met.

Dean's Honors and Commendation Lists—The Faculty of the School recognizes meritorious scholastic achievement by a Dean's Honors List and a Dean's Commendation List, which contain the names of candidates for undergraduate degrees whose scholastic achievements satisfy all of the following requirements while enrolled in an approved engineering curriculum:

1. The student must have completed a minimum of 13 semester hours in one semester with a quality-point index of 3.5 or higher for the Dean's Honors List and a quality-point index of 3.0 or higher for the Dean's Commendation List, with no more than one grade of *C*.
2. No grade below *C* may have been received during the qualifying period.
3. No disciplinary action may have been taken against the student.

The grades used to compute the quality-point index for eligibility for the Dean's Honors and Commendation Lists are those used to meet the SEAS graduation requirements. A student who receives a grade of *I* during a semester may not be placed on the Dean's Honors or Commendation List for that se-

mester unless the *I* is removed no later than one month after the end of the marking period and the student continues to meet all the requirements for the Dean's Honors or Commendation List.

Note: Grades discussed in the paragraphs above include all grades earned at George Washington University and through the Consortium universities while the student is enrolled at George Washington University. The grades considered are for academic courses taken in fulfillment of degree requirements and as prerequisites for degree requirements, and not for other courses that may be taken (for example, EFL courses numbered 45 and below will not be considered for purposes of probation, suspension, or Dean's List).

Use of Correct English

Any student whose written or spoken English in any course is unsatisfactory may be reported by the instructor to the Associate Dean. The Associate Dean may assign supplementary work, without academic credit, varying in amount with the needs of the student. If the work prescribed is equivalent to a course, the regular tuition fee is charged. The granting of a degree may be delayed for failure to make up any such deficiency in English to the satisfaction of the Associate Dean.

Graduation Requirements

See page 223 for general requirements for graduation.

RESIDENCE

A minimum of 30 semester hours must be completed in residence. Summer work may be counted. Unless special permission is granted by the Dean to study elsewhere, the work of the final year must be completed in residence.

SCHOLARSHIP

To be eligible for graduation a student must have (a) a quality-point index of at least 2.20 in those technical courses specified in the fifth through the eighth semester of the curriculum and (b) a 2.00 overall average for the entire engineering academic program taken at SEAS.

HONORS

With Distinction—A bachelor's degree may be conferred "With Distinction," at the discretion of the Faculty, if a student attains a quality-point index of 3.50 or higher on all work taken at this institution that applies to his/her engineering program. To be eligible for this honor, a student must have completed at this institution at least one-half of this work required for the degree.

Special Honors—A bachelor's degree may be conferred with "Special Honors," at the discretion of the Faculty, for outstanding achievement in the student's senior year work on recommendation of the Faculty, under the following regulations:

1. The student must have candidacy for Special Honors approved by the department chairman representing the major field not later than the beginning of the senior year.

2. The student must meet such other conditions as may be set at the time candidacy is approved.

3. No student will be awarded Special Honors unless a quality-point index of at least 3.00 is achieved on all work taken at this institution that applies to his/her engineering program.

4. To be eligible for Special Honors a student must have completed at this institution at least one-half of the work required for the degree.

UNDERGRADUATE CURRICULA

The four-year undergraduate curricula lead to the degree of Bachelor of Science, with parenthetic designation of the major; for example, Bachelor of Science (Electrical Engineering). Students who are deficient in preparation require a longer period; those who are admitted with advanced standing or who attend summer sessions can complete the requirements in less time.

The program of the first four semesters (core curriculum), with minor exceptions, is common to all curricula and provides the essential broad base of scientific principles and mathematical techniques necessary for the professional courses of the last four semesters, together with an appropriate background in the humanities and social sciences (see below).

A minimum total of 130 semester hours is required to qualify for the degree. Certain options may require more than the minimum. However, students are encouraged to elect additional course work above the required minimum to the extent that their interests and the School's offerings permit.

Degrees are offered in Civil Engineering, Electrical Engineering, Mechanical Engineering, and Operations Research and Computational Science. Students in Civil Engineering may select options in Geotechnical Civil Engineering; students in Mechanical Engineering may select options in Computer-oriented Mechanical Engineering and in Energy Resources and Power-oriented Mechanical Engineering. Electrical Engineering provides options in Computer Science and Premedical Engineering.

For the guidance of the student and the adviser, beginning freshmen who have not waived English Composition 9 or 10 through their English Composition Achievement Test scores or the TWSE (see page 19) or who have not received credit for a college-level calculus course must take the placement examinations in English and mathematics. A student who is deficient in mathematics may be required to take remedial work. Results on the English placement test determine the level of the English course the student will take.

Courses in the Humanities and Social Sciences

The program in the humanities and social sciences for engineering students assists them in acquiring knowledge which will permit an understanding of the cultural and humanistic elements of the past and present and an analysis of problems facing society today. The ultimate goal is to help the engineer have a better understanding of society and an appreciation of the engineer's role and responsibilities within it.

Since the education of an engineering student is, by necessity, oriented toward technical subjects, the program in the humanities and social sciences should not emphasize technical aspects and skills, but should rather consist of courses which broaden the outlook. As a consequence, courses in subjects

such as accounting, finance, industrial management, introductory languages, and personnel administration should not be included in the humanities and social sciences program. On the other hand, courses in areas such as anthropology, economics, geography, history, literature, philosophy, political science, psychology, and sociology are considered appropriate.

Engineering students are required to prepare, with the assistance of their faculty adviser, a program of courses in the humanities and social sciences, explaining how the program meets the purpose stated above. The student's program must include a minimum of 18 semester hours and must be approved by both the adviser and Department Chairman.

Modern Laboratory Facilities and Research Opportunities

Laboratories at the School of Engineering and Applied Science are constantly updated to keep them in line with current engineering practice. Assignments in the classroom and laboratory are arranged to supplement each other.

The learning experience is made more meaningful when coupled with research activities. Students may involve themselves in the various kinds of research activities in progress at SEAS. Research is being conducted in structural mechanics, fluid mechanics, thermal sciences, materials science, medical engineering, computer science, electronics, communications networks, energy technology, and other areas.

SEAS provides a wide variety of computing facilities for student and faculty use. Located on the fourth floor of Tompkins Hall, the SEAS Computing Facility includes an HP 3000 computing system with 12 time-shared interactive CRT terminals and remote telephone access; 14 Apple microcomputer disk-based computer systems; a VAX 11-780 computing system, primarily intended for color and black and white computer graphics research; and a laboratory for instruction in microprocessor software and hardware development.

A wide variety of high-level languages, as well as machine and assembly languages, are supported. The Facility provides technical and operational assistance to all users during normal operating hours: 9 a.m.-11:30 p.m. Monday-Friday, 12 noon-6 p.m. on weekends.

Additional computing facilities, not under the purview of the SEAS Computing Facility, are available to students and faculty at the Center for Academic and Administrative Computing (see page 225) and throughout the various specialized laboratories in SEAS.

The varied laboratory facilities available to complement classroom study and conduct research also include an MTS random-cycle fatigue testing system; a fully instrumented wind tunnel; a combined water tunnel and circulating water channel; a water pollution laboratory; an air pollution laboratory; a soil and foundation engineering laboratory; electrical engineering laboratory with oscilloscopes, signal generators, digital multimeters, power supplies, and other related equipment; microprocessor laboratory with modern microcomputers (Imsai Z80); digital computer laboratory with modern microcomputer trainers (6800 Microprocessors); a materials science and engineering laboratory with a electron scanning microscope; a thermal science laboratory; and general mechanical engineering and applied mechanics laboratories. Arrangements can also be made for use of special equipment at various government laboratories, such as the Naval Research Laboratory, the National Bureau of Standards, and the National Aeronautics and Space Administration.

Graduate Study

The School of Engineering and Applied Science offers graduate study leading to the degrees of Master of Science, Master of Engineering Administration, and Doctor of Science, and to the Professional degrees of Engineer and Applied Scientist.

In its graduate programs, the School, as it does in undergraduate study, adheres to the educational philosophy of increasing the knowledge and understanding of the individual student by concentration on principles and their application rather than by encyclopedic coverage of techniques and specialized detail. Each program is individually planned according to the student's preparation and needs.

Graduate study may be undertaken in any field of engineering or applied science in which the School has adequate facilities and resources. Upon approval, the student may select courses in other departments of instruction in the University to serve specific needs or objectives. A complete list of available fields and areas of concentration is included under each departmental listing in the "Programs of Study and Courses of Instruction" section of this Bulletin beginning on page 58.

MASTER'S DEGREE PROGRAMS

The student's program may provide for broad coverage in a variety of fields or may be designed to provide a concentration in particular areas. The minimum program consists of 24 semester hours of approved graduate courses and a Master's thesis (equivalent to 6 semester hours). With the approval of the department the student may elect an optional program without a thesis which



consists of a minimum of 33 semester hours of approved graduate courses. All Master's candidates are required to pass a Master's Comprehensive Examination. Students whose undergraduate study does not include necessary prerequisites may be required to take more than the minimum semester hours required.

Upon admission the student is assigned an adviser. Programs of study are determined by any prerequisites established and by the requirements of the department in which the student wishes to study. The program of studies in preparation for the Master's Comprehensive Examination must be approved by the student's adviser and the appropriate department chairman.

Admission

Admission to graduate study toward a Master's degree requires an appropriate Bachelor's degree from a recognized institution and evidence of capacity for productive work in the field selected, such as may be indicated by undergraduate grades, Graduate Record Examination* scores, and similar data.

An applicant who has significant deficiencies in preparation may be required to take prescribed undergraduate courses as an Unclassified student before being admitted to graduate student status. In some cases, if such deficiencies are minimal, he or she may be admitted directly to graduate student status and allowed to take a limited number of graduate courses while completing the undergraduate courses in which he or she is deficient. In no case may the undergraduate deficiency courses thus taken fulfill any part of the requirements for the Master's degree.

For additional admissions requirements for the degrees of Master of Engineering Administration and Master of Science in the Department of Engineering Administration, see pages 175 and 179; for the degree of Master of Science in the Department of Operations Research, see page 198. Candidates for the degree of Master of Science in the Department of Electrical Engineering and Computer Science must have satisfied specific undergraduate requirements, depending upon the area of concentration.

ADMISSION PROCEDURE

Admission application forms are available from the School of Engineering and Applied Science. They must be submitted, together with the nonrefundable application fee of $25, to the Manager of Engineering Admissions, Room 103, Tompkins Hall of Engineering, George Washington University, Washington, D.C. 20052, no later than August 1 for the fall semester, December 15 for the spring semester, May 1 for the first summer session, June 1 for the second summer session, and July 1 for the third summer session. The applicant must request that each educational institution attended since high school graduation send an official transcript of the student's record directly to the Manager of Engineering Admissions. Although not required, the applicant who has completed the Graduate Record Examination should request that the scores be sent to the School. The applicant will be notified by mail when a decision on admission has been made. English language and other pertinent requirements for international students are outlined on pages 15–18.

All inquiries and correspondence relative to graduate admission should be directed to the Manager of Engineering Admissions.

*Graduate Record Examination (GRE) scores are not required for admission to SEAS; however, students who have taken the GRE are encouraged to submit their test results.

ENGLISH LANGUAGE REQUIREMENTS FOR GRADUATE ADMISSION

If a student's native language is not English, the student must demonstrate proficiency in English before a decision will be made on his or her admissibility. The Test of English as a Foreign Language (TOEFL) and the American Language Institute of Georgetown University (ALIGU) are tests recognized by George Washington University. The results of one of these tests must be forwarded by the institution administering the test.

Program Assignments Based on English Test Scores—Admitted students achieving a score of 550 or higher on TOEFL or 85 or higher on the usage test of the ALIGU will not have to take any additional English tests to determine the technical program they will follow at the School of Engineering and Applied Science.

International students who are admitted and whose scores range between 425 and 550 on TOEFL or between 55 and 84 on the usage test of the ALIGU will be required to take the George Washington University English Proficiency Test to determine the level of the English course to be taken and the maximum number of technical courses that can be taken in any semester. Students admitted with English requirements should expect to spend more than the normal amount of time in completing their studies at the University than do native U.S.) students.

International students who score below 425 on TOEFL or below 55 on the ALIGU usage test will not be admitted to the University in a full degree status. However, international students seeking admission to the School who have met of the normal technical requirements for admission *with outstanding academic records*, but who do not meet the English language requirements, may be admitted on a provisional admission basis. Such students may enter full admission status only when they have successfully completed the level of EFL 30 (see page 17) within one calendar year of the date of registration.

International students transferring from an academic institution in the United States or from another English-speaking institution or who have demonstrated English proficiency at those institutions may, at the discretion of the admitting officer, be admitted without a TOEFL or ALIGU test, but they may be required to take either the George Washington University English Proficiency Test or an English composition placement test prior to registration.

International students in the United States who are able to schedule the English Proficiency Test at George Washington University may use the results of this test in lieu of the TOEFL or ALIGU usage test.

TRANSFER CREDIT

Up to 6 semester hours of satisfactory credit (with grades of *A* or *B*), which normally must have been earned in a graduate program at another recognized institution, *may* be accepted in transfer, when applicable, to satisfy Master's degree requirements in this School. However, students must, with the approval of their adviser, petition to the appropriate Department chairman for such a transfer. Credits used in obtaining a previous degree may not be used for another degree at SEAS.

Registration

A graduate student may register for classes upon presentation of an official letter of admission or a Student Identification Card from the previous semester. No registration is accepted for less than a semester or one summer session.

Concurrent registration in this School and in another institution not a member of the Consortium of Universities of the Washington Metropolitan Area, Inc., or another division of this University requires the written permission of the Deans concerned, *prior to registration*. Allowance of credit for work done concurrently at another institution is at the discretion of the Dean. The necessary forms for requesting concurrent registration are available from the SEAS Admissions Office.

Dates and hours of registration are stated in the Calendar, page 4, and in the *Schedule of Classes* published in advance of each semester.

Master's Thesis

In those programs requiring a thesis, the degree candidate must submit an acceptable thesis to demonstrate the ability to make independent use of the knowledge and discipline of thought acquired and developed by graduate study, to furnish objective evidence of constructive power in a given field, and to demonstrate the ability to communicate the results of the work in writing. Work of a suitable character for which the student has professional responsibility may be considered, whether done on or off campus, provided no significant amount of work is completed without faculty supervision.

As a part of registration for the thesis course 299, the candidate must submit the thesis area to the appropriate department chairman, on the form obtained from the School office and approved by the faculty adviser. The candidate must submit the thesis title to the Dean, on the form available in the School office, at the beginning of the semester of expected graduation. Registration in thesis 299–300 entitles the student, during such registration, to the advice of the member of the faculty under whom the thesis is to be written. Students may consult their adviser, but they have primary responsibility for the thesis.

The thesis in final form must be submitted to the appropriate department chairman by the date stated in the calendar for the semester in which the candidate enrolls in thesis 300. In case a thesis is unfinished on the date specified, the student will be granted an additional semester. If the preparation of the thesis extends beyond the three semesters, approval for an extension of time will be required and the student must reregister for thesis 300 and pay tuition as for a repeated course. The overall time limit for earning the degree (see pages 32–33) may not be exceeded.

A thesis may be submitted in final form one time. The acceptability of the thesis is determined exclusively by the Master's Comprehensive Examination committee. If the thesis is unacceptable, the student's graduate status is terminated.

Printed copies of detailed regulations regarding the form and reproduction of the thesis are available in the Office of the School. Accepted theses, with accompanying drawings, become the property of the University and are deposited in the University Library, where the duplicate copies are bound and made available for circulation.

Optional Master's Program without a Thesis

With the approval of the appropriate department, a student may elect an optional program without a thesis which consists of a minimum of 33 semester hours of approved graduate courses.

Master's Comprehensive Examination

The student must pass a Master's Comprehensive Examination to demonstrate substantial understanding of principles and methods and their use in the area of interest. This Examination may be written, oral, or both. A graduate student who fails any portion of the Master's Comprehensive Examination on the first attempt may be examined one more time if approval is given by the appropriate Examining Committee. In the event of failure to complete the Examination satisfactorily, the student's graduate status terminates.

Regulations

Regulations regarding REGISTRATION, FEES, AND FINANCES *are stated on pages 210–215; other University regulations, on pages 221–25.*

ATTENDANCE

Students may not attend classes until registration is completed and fees due are paid or appropriate arrangements are made with the Office of Student Accounts. They may attend only those classes for which they are registered. Students are expected to attend every meeting of the course in which they are registered, and prepared to carry on the work required. Students may be dropped from a course for undue absence.

SCHOLARSHIP

Grades are indicated as *A*, Excellent; *B*, Good; *C*, Minimum Pass; *F*, Fail; *P*, Credit (for satisfactory thesis completion); *I*, Incomplete; *IP*, Progress; *W*, Authorized Withdrawal; *Z*, Failure, Unauthorized Withdrawal, or failure to take the final examination.

Students who receive two grades of *F* or *Z*, or both, or three grades below *B* are barred from further enrollment in graduate courses and, ordinarily, will not be readmitted to graduate study.

At the option of the instructor, the grade of *I* may be recorded if a student, for reasons beyond the student's control, is unable to complete the work of the course, and if the instructor is informed of and approves such reasons before the date when grades must be reported. The grade may be used only if the student's prior performance and class attendance in the course have been satisfactory. Any failure to complete the work of a course which is not satisfactorily explained to the instructor before the date when grades must be turned in will be graded *F*. If acceptable reasons are later presented, the instructor may initiate an appropriate grade change. Although the grade of *I* may remain on the records for a maximum of one year, the instructor should normally set a much briefer period within which the uncompleted work must be made up. The grade of *I* cannot be removed by the student's reregistering in the course here or taking its equivalent elsewhere. An incomplete which is not removed within one calendar year is automatically changed to an *F*.

A student may not repeat for credit a course in which the student has received a grade of *C* or above, unless required to do so by the department concerned. A written statement requiring the student to repeat such a course for credit must be submitted to the Registrar by the appropriate department chairman.

Pass-No Pass Grading System—SEAS students may take SEAS courses under the pass/no pass grading system, but credit for such courses cannot be used toward any degree program in SEAS.

GRADUATION REQUIREMENTS

Thesis—In addition to 6 credit hours of acceptable thesis, a student may graduate with either:

1. 24 credit hours of *B* or better with no more than two grades below *B* of which only one *F* is permitted; or

2. A 3.00 quality-point index with a minimum of 24 credit hours with no more than two grades below *B* of which only one *F* is permitted.

Nonthesis Option—A student may graduate with either:

1. 33 credit hours of *B* or better with no more than two grades below *B* of which only one *F* is permitted; or

2. A 3.00 quality-point index with a minimum of 33 credit hours with no more than two grades below *B* of which only one *F* is permitted.

Quality-point Index—Scholastic standing is computed in terms of the quality-point index obtained by dividing the number of quality points by the number of semester hours for which the student registered.

Quality points are computed from grades as follows: *A*, 4.00 points; *B*, 3.00 points; *C*, 2.00 points; *F*, no points, for each semester hour for which the student registered. Courses marked *W* or *I* are not considered in determining the index, except that courses marked *I* will be considered when a formal grade is recorded. Grades in courses taken at other institutions are not considered in computing the quality-point index, with the exception of courses taken at one of the Consortium universities.

RESIDENCE AND CONTINUOUS STUDY

All work for the degree must be done in residence on the campus except when special permission is granted by the Department Chairman. The student must maintain continuous enrollment in the School. Failure to do so breaks the student's registration, and the student must apply for readmission to the Master's degree program under whatever conditions and regulations are in effect at that time.

TIME LIMITS

A full-time student in the Master's program is allowed a maximum of three calendar years (excluding the time spent taking only English as a Foreign Language courses) to complete all degree requirements, from the date of the student's first graduate-student status registration in prerequisite or graduate courses. A part-time student in the Master's program is allowed a maximum of five calendar years. The time limit does not include any period of registration

as an unclassified student before admission to graduate student status, nor does it encompass any specified period spent on approved leave of absence.

Students who do not complete degree requirements within the allowed time will have their graduate status terminated. They may be readmitted to graduate status under conditions specified by the Department Chairman and approved by the Dean.

PROFESSIONAL DEGREE PROGRAM

The School of Engineering and Applied Science has established the Professional degree program to provide an educational program for those students who are interested in pursuing course work beyond the Master's degree, with emphasis on applied subject material rather than on basic research.

Successful completion of the Professional degree program leads to the degree of Engineer or degree of Applied Scientist.

In the Professional degree program, the School adheres to the educational philosophy of increasing the knowledge and understanding of the individual by concentration on principles and their application. This approach should provide the students with a technical flexibility to enable them to adapt successfully to rapidly changing technology. Each program is individually planned according to the student's background and needs and is subject to departmental requirements.

The Professional degree program has been designed to satisfy the needs of industry and government for highly trained and educated technical personnel in engineering and applied science.

Professional Degree Study Programs

The Professional degree program provides graduate study in those fields of engineering or applied science in which the School has adequate facilities and resources. Upon approval, the student may select courses in other departments of instruction in the University to serve specific needs or objectives.

The student's program may provide for broad coverage in a variety of fields or may be designed to provide a concentration in particular areas. The minimum program consists of 30 semester hours of approved graduate courses beyond a Master's degree. Students whose graduate study does not include necessary prerequisites may be required to take more than the minimum semester hours required.

Admission

Admission to graduate study toward the Professional degree requires an approved Master's degree from a recognized institution and evidence of capacity for productive work in the field selected as indicated by prior scholarship and, where appropriate, professional experience.*

REQUIREMENTS

Engineer—To study toward the degree of Engineer, an applicant must possess a Master's degree and a bachelor's degree in an area of engineering.

*The Department of Electrical Engineering and Computer Science requires candidates for the Professional degree program to have had two years of professional experience after having received the Master's degree.

2. *Applied Scientist*—To study toward the degree of Applied Scientist, an applicant must possess a bachelor's degree in either engineering, mathematics, or natural science; and a Master's degree in either engineering, natural science, mathematics, or administration. Applicants having an equivalent quantitative background may be considered as special cases by the respective departments.

Normally, a *B* average in graduate work is required. However, the minimum does not assure automatic acceptance; the departments may, and often do, set higher admission standards.

ADMISSION PROCEDURE

Forms for application for admission are available at the School of Engineering and Applied Science. They must be submitted, together with the nonrefundable application fee of $25, to the Manager of Engineering Admissions, Room 103, Tompkins Hall of Engineering, George Washington University, Washington, D.C. 20052, no later than August 15 for the fall semester, December 15 for the spring semester, May 1 for the first summer session, June 1 for the second summer session, and July 1 for the third summer session. The applicant must request each educational institution attended since high school graduation to send an official transcript of the student's record directly to the Manager of Engineering Admissions. The applicant will be notified by mail when a decision on admission has been made. English language and other pertinent requirements for international students are on pages 15–18.

All inquiries and correspondence relative to graduate admission should be directed to the Manager of Engineering Admissions.

TRANSFER CREDIT

Up to 6 semester hours of satisfactory credit (with grades of *A* or *B*) beyond a Master's program, which must have been earned in the five years preceding the start of study toward the Professional degree, may be accepted in transfer when applicable to satisfy Professional degree requirements in this School. However, students must, with the approval of their adviser, petition the appropriate Department Chairman for such a transfer. Credit used in obtaining a previous degree may not be used as transfer credit.

Program of Study

Upon admission, the student is assigned an adviser. Programs are determined by established prerequisites and the requirements of the department in which the student wishes to study. The program of studies for each Professional degree candidate must be approved by the student's adviser and the appropriate Department Chairman.

An applicant who has significant deficiencies in preparation may be required to take prescribed undergraduate and graduate courses as an Unclassified student before being admitted to Professional degree candidate status. In no case may courses thus taken fulfill any part of the requirements for the Professional degree.

Each individual department may require the degree candidate to undertake and defend the results of a technical design project, development problem, or the preparation of a comprehensive technical report to demonstrate the candidate's ability to make independent use of the knowledge and discipline of

thought acquired and developed by graduate study. When applicable, the student will be informed of this requirement by the faculty adviser at the time the student's program is being formulated.

In no case, however, will this project be more than 6 credit hours out of a minimum of 30 credit hours.

Scholarship

No student studying for the Professional degree may receive more than two course grades below *B*. If more than two course grades below *B* are received, study is terminated and further enrollment is prohibited. A student must achieve a final quality-point average of 3.00 to receive the degree.

Time Limits

A full-time student in the Professional degree program is allowed a maximum of three calendar years to complete all degree requirements, from the date of the first graduate student status registration in prerequisite or graduate courses. A part-time student in this program is allowed a maximum of five calendar years. The time limit does not include any period of registration as an unclassified student before admission to graduate student status, nor does it encompass any specified period spent on approved leave of absence. Upon expiration of leave of absence, readmission is required under the conditions and requirements in effect at the time of the student's readmission.

Students who do not complete degree requirements within the allowed time will have their graduate status terminated. They may be readmitted to graduate status under conditions specified by the Department Chairman.

Interrelationship with the Doctoral Program

Candidates for the D.Sc. degree or Professional degree who are in good academic standing may, with the approval of the faculty adviser and department chairman, transfer from one degree program to the other, if they meet necessary qualifications and requirements as specified by the appropriate department.

Residence and Continuous Study

All work for the degree must be done in residence on the campus except when special permission is granted by the Department Chairman. The student must maintain continuous enrollment in the School. Failure to do so breaks the student's registration, and the student must apply for readmission to the Professional degree program under whatever conditions and regulations are in force at that time.

DOCTORAL DEGREE PROGRAM

The School of Engineering and Applied Science offers a program of advanced study and research leading to the degree of Doctor of Science. This program is limited to those fields in engineering or applied science in which a discipline has been established and for which the University has or can arrange adequate resources.

The doctoral program is designed to prepare the student for a career of creative scholarship by providing a broad but balanced background of knowledge and guidance in the performance of research. It requires study of interrelated fields of learning as well as original research in the field of central interest.

The program for the degree is divided into two stages. The first—made up of a study of interrelated fields of learning which supports the general area of research concentration—culminates in the qualifying examination. The second—composed of research investigation of a particular subject in a special field and the presentation of such research findings in a written dissertation—culminates in the final examination.

Admission to Doctoral Study

A satisfactory Master's degree from an accredited institution is required, together with acceptable personal qualities and a capacity for creative scholarship. Normally, a *B* average in graduate work is required. However, the minimum does not assure automatic acceptance: the departments may, and often do, set higher admission standards.

ADMISSION PROCEDURE

Forms for application for admission are available at the School of Engineering and Applied Science. They must be submitted, together with a nonrefundable application fee of $25, to the Manager of Engineering Admissions, Room 103, Tompkins Hall of Engineering, George Washington University, Washington, D.C. 20052. The prospective doctoral student seeking admission should apply before June 1 for the fall semester and before December 1 for the spring semester. Personal interviews may then be arranged to discuss the applicant's qualifications and the possibilities for an effective doctoral program. The applicant must arrange for complete documentary records (transcripts) to be forwarded to the Manager of Engineering Admissions in sufficient time to permit assembly of complete records for evaluation as soon after the above application deadlines as possible.

The applicant must arrange for letters of recommendation to be submitted from two faculty members of the institution from which the student received the Master's degree; one of these, if possible, should be from the Master's adviser. The letters should be addressed to the appropriate department chairman.

English language and other pertinent requirements for international students are given on pages 15–18.

Language Requirement

The importance of scientific and technical contributions originating from foreign countries is emphasized. Some areas of study demand the capability of reading appropriate literature in a foreign language. In such situations individual departments have the option of requiring a reading knowledge of such a language.

Tool Requirement

In addition to the language requirement, an examination in a tool requirement (*e.g.*, computer programming) may be established by the various departments.

Study for the Qualifying Examination

Upon admission to the first stage of the program, *i.e.*, study of interrelated fields culminating in the qualifying examination, the student is assigned a fac-

ulty adviser who directs his studies.* The adviser approves appropriate fields of study to insure the student's breadth of knowledge and to support research in the central field of interest, gives advice concerning the scope and content of fields of study, and guides preparation for the qualifying examination. Programs of study are normally structured to include a major field of study and two minor or supporting fields.

A minimum of 30 semester hours of credit in a formal program at the graduate level beyond Master's study is required. In many cases, particularly when the student undertakes a doctoral program in a field other than that in which the student obtained the Master's degree, the program of studies exceeds 30 semester hours.

Students admitted to doctoral study are encouraged to undertake one year of full-time study on campus. In general, the adviser will require the student to register for a minimum of 6 semester hours of course work in every semester except the summer sessions.

Transfer of Credit

Up to 6 semester hours of credit earned in courses completed with the grade of *A* or *B* while enrolled in a doctoral program at another accredited institution may be accepted in transfer to satisfy doctoral requirements of this School, subject to the approval of the student's adviser and the Department Chairman. Credit earned in courses completed more than five years prior to admission to the doctoral program will not be accepted in transfer, and some departments may require that transfer credit must have been earned within a shorter period of time before admission. Credit for courses taken for a previous degree may not be transferred.

The Qualifying Examination†

The purpose of the qualifying examination is to ascertain that the student's background and intellectual development are adequate to support doctoral research in the central field. Qualifying examinations may be written or oral, or both, and are scheduled over a period of several days. They are conducted only during the fall and spring semesters on dates established by the departments and are administered by a faculty committee. Upon favorable report of the examiners to the Dean through the appropriate department chairman, the student is admitted to candidacy for the degree; the student then begins specialized study and research under the supervision of a designated member of the faculty or, in special instances, an outstanding engineer/scientist who is not a member of the faculty.

The qualifying examination is the principal means used to determine the student's ability to qualify as a candidate for the doctoral degree and to enter the second stage of the program.

At the discretion of the committee which prepared the examination, the doctoral student may be given a second opportunity to qualify for candidacy in the

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*In some departments, instead of a faculty adviser, a faculty committee may be appointed to approve programs, direct study, and carry out all other responsibilities of the faculty adviser.

†Some departments may administer a pre-qualifying examination prior to completion of the study program.

event of failure in any part of the qualifying examination. In general, the entire qualifying examination must be retaken by the student in order to qualify for candidacy.

Scholarship

To be admitted to the qualifying examination, the doctoral student must achieve an overall quality-point average of 3.20 (quality points are computed as follows: *A*, 4.00 points; *B*, 3.00 points; *C*, 2.00 points; and *F*, no points). No doctoral student may receive more than two course grades below *B*. If the student does receive more than two course grades below *B*, the graduate study is terminated and further enrollment is prohibited. Courses in which the student earns grades below *B* are not included in the total semester-hour requirement for the degree. Students who receive any grade below *B* are required to consult with their adviser for a review of their program of study and discussion of possible changes therein.

Research, Dissertation, Final Examination

The student admitted to candidacy for the degree of Doctor of Science requests as Director of Research, the member of the faculty under whom the student wishes to conduct research. The faculty member may accept or reject such request. The research area is approved by the Director. Throughout the remainder of the doctoral program the candidate conducts dissertation research directly under the Director. However, the student is not precluded from consulting with other members of the faculty, as may be required, on an informal basis, and may be encouraged to do so by the Director of Research. A committee of the faculty consisting of three members including the Director as chairman will advise in the final preparation of the dissertation. The Department Chairman appoints such a committee on the recommendation of the Director of Research. Work on the dissertation is equivalent to a minimum of 24 semester hours. See page 211 for minimum hour-loads for doctoral students.

THE DISSERTATION

A dissertation is required as evidence of ability to perform original scholarly research and to present and interpret the results. The student is solely responsible for the content of the dissertation.

The aim of the student in this stage of candidacy is the production of a dissertation which embodies the results of an extended original study and which includes material deemed worthy of publication in recognized scientific and engineering journals. The student is expected to attempt to publish the results of the research as soon as possible after the student receives the degree and to submit copies of the published material to the Dean. Credit must be given in the publication to the fact that the material is abstracted, summarized, developed, etc., from a dissertation submitted to George Washington University in partial fulfillment of the requirements for the Doctor of Science degree.

The candidate must submit to the appropriate department five complete copies of the dissertation and an abstract (not to exceed 600 words) of the dissertation no later than the date specified in the calendar. The abstract is included in the announcement of the examination and is reproduced by University Mi-

rofilms, Inc. One copy of the dissertation is also sent to University Microfilms, nc.

Printed copies of detailed regulations regarding the form and reproduction of the dissertation, preparation of the abstract, and services offered by University Microfilms, Inc., are available at the School office. The successful candidate for the doctorate is required, before receiving the degree, to pay a fee to cover a part of the expense of printing the abstract of the dissertation, and for the basic service rendered by University Microfilms, Inc. Accepted dissertations, with accompanying drawings, become the property of the University and are deposited in the University Library, where bound copies are available for circulation.

THE FINAL EXAMINATION

Upon acceptance of the dissertation by the committee, consisting of the Director and two other faculty members of this School, which has assisted in supervising its final preparation, the candidate is presented for the final examination. The final examination is oral and is open to the public. The candidate must demonstrate a mastery of the special fields of study and of the materials and techniques used in the research. The committee of examiners will consist of not less than five members, three of whom must be full-time faculty members. The committee may include qualified experts brought to the University especially to participate in the examination. The Director of Research serves as advocate for the candidate. When the candidate satisfies the examining committee of the high quality and originality of the candidate's contribution to knowledge as well as the mastery of the scholarship and research techniques of the field, the committee of examiners recommends the candidate for the degree of Doctor of Science. The final examination is conducted only during the fall and spring semesters. The candidate should consult with the appropriate department chairman as to possible dates for the examination.

Residence and Continuous Study

All the work for the degree must be done in residence on the campus, except when special permission is granted by the Department Chairman. The student must maintain continuous enrollment in the School. Failure to do so breaks the registration, and the student must apply for readmission to doctoral study under whatever conditions and regulations are in effect at that time. In case of incapacity or other legitimate reasons, the student may be granted a leave of absence of up to one year. Extension of such leave will require special request to and approval of the appropriate department chairman. During approved leave of absence, the student must maintain continuous enrollment. The time period for completion of all requirements for the degree will be adjusted on the basis of the approved leave of absence.

In general, one year of study is the minimum amount of time to be spent in preparation for the qualifying examination. The qualifying examination must be completed within five years of the date of admission, and the entire degree program must be completed within seven years. After admission the student may apply for the qualifying examination whenever the student feels properly prepared. A minimum of two years of full-time study and research should be expected in meeting the requirements for the degree.

Special Programs

INSTITUTE FOR THE STUDY OF FATIGUE, FRACTURE, AND STRUCTURAL RELIABILITY

The basic objective of the Institute for the Study of Fatigue, Fracture, and Structural Reliability of the School of Engineering and Applied Science is to develop an interdisciplinary approach to fatigue research through close cooperation of research workers from different fields. The Institute deals principally with the study of the physical mechanism of damage initiation, in order to establish principles for the rational design of metal alloys of superior fatigue performance on the one hand, and to develop advanced methods of fatigue design and reliability on the other. Because of the large volume, past and current, of straight fatigue testing of standard test specimens in industrial, government, and university laboratories, no testing of this type is generally conducted by the Institute. However, results of such tests appearing in publications and reports are carefully scrutinized for their significance in terms of the purposes of the Institute. In addition to advancing interdisciplinary research, the Institute provides specialized training for graduate students.

The Institute conducts seminars, issues technical reports, and supplies information, lectures, and consultations to many government and industrial research and development laboratories.

INSTITUTE FOR MANAGEMENT SCIENCE AND ENGINEERING

The Institute for Management Science and Engineering defines and develops new analytical management techniques required to keep pace with an ever-expanding technology. It provides a multidisciplinary environment for innovative graduate teaching and substantial opportunities for research activities and public service under diversified sources of external support. The principal academic fields directly involved are operations research, mathematics, statistics, economics, and the computer sciences.

The programs of the Institute are concerned with important educational and public-service needs for conservation of national resources. Such programs require full-time interaction among students, faculty, and staff in ways possible only at universities. Through its Program in Logistics, the Institute performs research leading to the development of a science of logistics featuring principles and methodology for resource allocation problems in civil affairs and national defense efforts. Other programs involve optimization, reliability, queuing, forecasting, and cost benefit analyses.

Participation by faculty members and graduate students from all schools in the University is encouraged as consistent with the multidisciplinary objectives of the Institute. Qualified graduate students may obtain financial support through research assistantships, with thesis and dissertation efforts ordinarily being the major work responsibilities. Reliance is also placed on staff research specialists, and there are special provisions for substantial contributions from distinguished visitors from government, private industry, and other universities.

The Institute disseminates its results through seminars, colloquia, conferences, and a special series of monographs. All research is unclassified.

INSTITUTE FOR RELIABILITY AND RISK ANALYSIS

The objective of the Institute for Reliability and Risk Analysis is to promote basic and applied research in reliability theory and risk analysis within the framework of a university environment. In the pursuit of this objective, participation by and interaction among faculty members, visiting professors, scientists from government and industry, and graduate students is sought.

Qualified graduate students may be supported through research assistantships; their major work efforts consist of research toward the dissertation.

The Institute sponsors seminars for the general public and the university community and publishes technical papers and other reports to disseminate research results.

INTERNATIONAL WATER RESOURCES INSTITUTE

The International Water Resources Institute was created to foster a multidisciplinary approach to the planning, development, and operation of water resources systems and the solutions to water resources problems on both the national and international levels.

The Institute emphasizes basic and applied research, technical development, transfer of knowledge, professional and scientific services, and special educational needs within the University and abroad.

The Institute supplies information to various government agencies and private concerns nationally and internationally and conducts seminars. It thus creates an international flow of knowledge of water resources problems and their possible solutions.

INSTITUTE FOR INFORMATION SCIENCE AND TECHNOLOGY

The Institute for Information Science and Technology, of the Department of Electrical Engineering and Computer Science, operates as a multi-disciplinary research organization, with its foundation in the field of science and engineering. It brings together the strength of disciplines from both the physical sciences and the social sciences, including law, education, government, psychology, political science, engineering, mathematics, geography, and others, in order to understand human-machine interactions and to understand appropriate designs for effective information systems for the future. The Institute operates with a core staff and relies on faculty and research contributors from George Washington University, as well as a broad range of other sources from government, industry, and academe. Visiting scholars and fellows from government and industry fill important research positions while pursuing advanced studies.

The Institute is organized to conduct interdisciplinary educational and training programs by integrating mid-level scientists and managers into Institute research programs in order to provide them with greater insight into the latest research findings in the field of information science and technology. There is a deliberate mix of permanent and adjunct staff: government, industry, and university staff; practitioners and researchers; senior researchers and students—cross-fertilization of the spectrum of skills and roles that can be brought to bear in the field of information science.

The Institute for Information Science and Technology produces research publications, grant and contract reports, and scholarly papers; systems designs

and developmental demonstrations; continuing education programs, seminars, and conferences; and trained staff and alumni.

THE GWU/NASA-LANGLEY GRADUATE PROGRAM

George Washington University, in cooperation with the National Aeronautics and Space Administration's Langley Research Center, has a full-resident graduate engineering program at NASA-Langley, in Hampton, Va., approximately 200 miles south of Washington, D.C.

The program is open to qualified NASA employees and area residents. Courses may also be taken by nondegree students, with the approval of the instructor. Students may be permitted to transfer a maximum of 6 semester hours of approved graduate course credit from other accredited institutions.

Courses in the program are taught by NASA scientists and engineers and the faculty of the School of Engineering and Applied Science. NASA-Langley's extensive scientific and engineering facilities and equipment are utilized whenever feasible.

The program at NASA-Langley leads to the degrees of Master of Science and Doctor of Science (by special permission of the appropriate department chairman) and to the Professional degree of Engineer in the fields of acoustics, aeronautics, environmental modeling (M.S. degree only), fluid mechanics and thermal sciences, solid mechanics and materials engineering, structures and dynamics, electrical engineering and computer science (M.S. degree only), and engineering administration (M.E.A. only).

Information regarding this program may be obtained from Professor John L. Whitesides, Jr., GWU-NASA Program, Mail Stop 169, NASA-Langley Research Center, Hampton, Virginia 23365.

The GWU/NASA-Langley Joint Institute for Advancement of Flight Sciences (JIAFS)

The Joint Institute for Advancement of Flight Sciences was established in 1971 through the combined efforts of the National Aeronautics and Space Administration's Langley Research Center and the George Washington University's School of Engineering and Applied Science. The objective of the JIAFS program is to meet the nation's ever-increasing needs in the advancement of science, engineering, and technology and to prepare qualified students for careers in research, development, design, and teaching. The Institute, which is located at the Langley Research Center in Hampton, Virginia, is dedicated to the advanced training of students and professional engineers in acoustics, aeronautics, environmental modeling, materials science, structures and dynamics, and other relevant areas, and serves to provide a center for advanced research by bringing together researchers and scholars from these fields for the exchange of ideas and findings. It is also the purpose of the Institute to provide the necessary facilities for qualified researchers and scholars who want to engage in research work in these areas.

The organization of the Institute consists of a director, Frank Hohl, Chief Scientist, NASA-Langley Research Center, and a co-director, Harold Liebowitz, Dean of the George Washington University's School of Engineering and Applied Science.

The education and research opportunities offered in the program combine the academic resources of George Washington University and the professional

research assets and facilities of the NASA-Langley Research Center. These opportunities also enable students to involve themselves in research projects that excite their interest and permit them to associate with prominent visiting members who are working on related problems. Most of the faculty and NASA scientists conduct research, and students take part in the intimate association of research and instruction from the day of their arrival. It is believed that the experience of the students during their stay at NASA-Langley Research Center will be highly rewarding and beneficial.

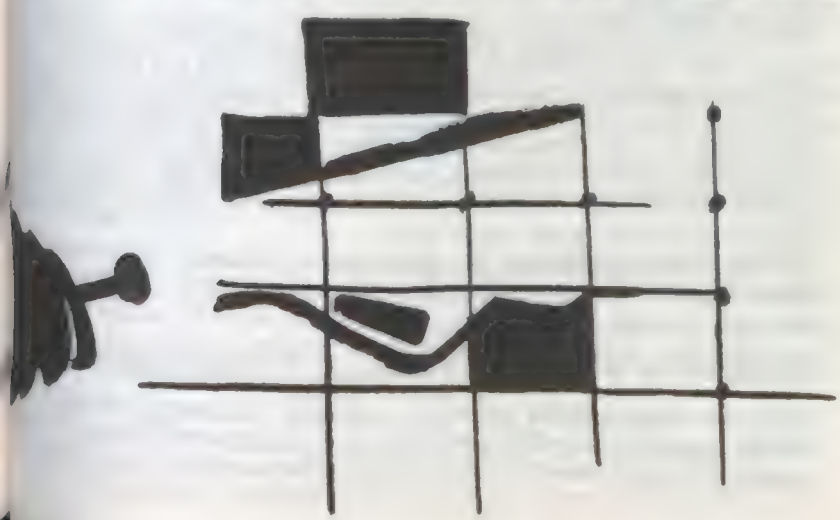
The current education and research programs are the following:

Acoustics Program—This program is concerned with the problems of alleviating noise and with providing a technical base for design of acceptable aircraft and space vehicles, noise resistant structures, and ground transportation systems. Areas of research interest include boundary-layer noise, duct acoustics, jet noise, nonlinear problems in acoustics, structural response to noise, and mechanical and acoustical coupling problems.

Aeronautics Program—This program deals with advanced flight concepts of various types of aircraft, including areas of performance, flight dynamics, instrumentation, guidance and control, aeroelasticity, and systems analysis. Specific research areas currently being investigated include aerodynamic analysis of jet augmented wings, theoretical fluid mechanics, performance, stability and control of aircraft, wind tunnel and flight testing of aircraft, airfoil aerodynamics, stall-spin characteristics of aircraft, and experimental evaluation of aircraft handling characteristics.

Structures and Dynamics Program—This program is designed to provide basic understanding and working knowledge of some key areas pertinent to structures, solid mechanics, and dynamics technology including computer-aided design; optimum design of aircraft and of aerospace and other structures; and the dynamic and aeroelastic response of large and complex structures. Emphasis will be placed not only on these individual areas but also on their interface and interaction.

Environmental Modeling Program—This program is aimed at developing mathematical models of various aspects of atmospheric energy and mass



transport and in applying these models both to the prediction of pollutant distribution and transport and to the interpretation of satellite and aircraft measurements. Because of the complexity of the earth-atmosphere system, simplified models are necessary to understand the effects of pollutants on the energy balance, the atmospheric circulation, and the chemistry of the system.

Materials Science Program—This program is concerned with analytic and experimental verification of processes which degrade mechanical properties of advanced composites; analysis of corrosion and stress-corrosion of materials in environments encountered by aerospace vehicles; analysis of creep and cyclic creep materials, based on both deterministic models and multiparameter regression; and prediction of mechanical properties of engineering materials in terms of composition, processing conditions, and service history.

Participating in these programs are Graduate Student Research Scholar Assistants, faculty from George Washington University, scientists and engineers from NASA-Langley, and visiting scientists and engineers.

A number of Research Scholar Assistantships are available to qualified students seeking an outstanding opportunity for graduate study and research leading to the degrees of Master of Science and Doctor of Science in the fields of Acoustics, Aeronautics, Environmental Modeling, Materials Science, and Structures and Dynamics. Applicants who are awarded Research Scholar Assistantships will receive stipends of up to $10,000 a year for a Master of Science degree and $11,000 a year for the Doctor of Science degree. Applications, a JIAFS brochure, and additional information may be obtained from Professor John L. Whitesides, JIAFS—George Washington University, Mail Stop 169, NASA-Langley Research Center, Hampton, Virginia 23665.

HONORS RESEARCH PROGRAM

An Honors Research Program has been established at the School of Engineering and Applied Science. Students who earn a grade point average of 3.3 or above, or who are admitted with a combined SAT score of 1250 and ranked in the upper 10% of their high school class, are invited to participate. The Program has been created to recognize and reward the academically gifted student with the opportunity to obtain a broad and enriched professional education in engineering.

Students who are admitted into the Program are assigned to selected engineering faculty for academic advising and guidance. They are afforded opportunities to participate in a number of specially designed laboratory experiments in the various engineering disciplines and a series of seminars conducted by well-known engineers and scientists. They will be permitted to carry an advanced-level engineering program and have an opportunity to earn up to 6 credits in lieu of technical electives. A notation on the student's transcript of participation in the Program can be made.

Qualified students interested in applying for the Program should contact the Honors Research Chairman of the department in which the research is to take place.

COOPERATIVE EDUCATION PROGRAM IN ENGINEERING

Cooperative education is a process of education that formally integrates the student's academic study with work experience in cooperating employer organizations. The usual plan is for the student to alternate periods of college study

with periods of experience in appropriate fields of industry and government. The experience periods are considered an integral part of the student's education. Cooperative education students in a work assignment period are considered full-time students for purposes of housing, campus privileges, and eligibility for financial aid. They are not considered as full-time students for Veterans Administration Benefits or visa purposes. Through the interaction of the study and work experiences, the student enhances academic knowledge, personal development, and professional preparation. The teaching faculty, the coordinators, and the employing supervisors share in the educational process of the cooperative student.

Advantages of Cooperative Education

Combines Theory and Practice—By coordinating the work experience in industrial and governmental organizations with the campus education program, theory and practice are closely integrated, and students find greater relevance in their studies. As a result of this alternation between academic and industrial environments, the student tends to understand the role and meaning of each environment, with a deeper appreciation for each.

Helps Finance Educational and Living Expenses—The student's earnings will contribute substantially to financing his own education and living expenses, leading to independence and contributing significantly to self-esteem and confidence. Working experience usually increases in difficulty and responsibility as the student progresses through the academic curriculum, and the salary of the student increases accordingly.

Serves as a Bridge to the Future—Cooperative education helps markedly to assist students to the world of work. Most students are genuinely concerned about their future life work. They want to know more about the range of occupations open to them, and the potentials and limitations of these fields. They want to know about the qualifications demanded and their own fitness. Through cooperative education programs, students have opportunities for exploring their own abilities in connection with real jobs, and they find a direct means of gaining information and guidance not only in the occupations in which they are employed but in a number of related fields as well. They have a chance to test their own aptitudes more fully than is normally possible on campus.

Increases Motivation to Achieve—The coordination of work and study increases student motivation. As students see connections between jobs they hold and the things they are learning in school, greater interest in academic work develops. During the work periods there is a tendency for the student to develop good work habits because his efforts as a productive and salaried employee are rated by the employer.

Enhances Human Relationships—Because the work experiences involve the students in relations with co-workers who come from a variety of backgrounds, and because success in these jobs requires constructive relationships with colleagues, most students in cooperative education develop deeper understanding of other people and greater skills in human relations.

Augments Development of Maturity—For many students the work experience contributes to an increased sense of responsibility for their own efforts, to dependence on their own judgments, and a corresponding development of maturity. In addition, the student's role as a team member in a real and pro-

ductive working environment inculcates a seriousness of life and purpose which is often delayed for the traditional college graduate.

Responsibilities of the Cooperative Student

The cooperative student working in association with the professionals in the field must adopt professional standards of conduct. Such a student is also a representative of the George Washington University School of Engineering and Applied Science. After each work period the student prepares a report describing the duties and responsibilities at work, and the supervisor sends an appraisal of the student's work performance to the Cooperative Program Coordinator. These reports are reviewed with the student.

The cooperative program is a three-way partnership among the student, the employer, and George Washington University. The student's responsibilities extend equally to each of the other two members of the partnership, and the partnership cannot be altered during the program without the knowledge and consent of all.

The cooperative student must maintain continuous enrollment in the School for each semester the student is away from the School on a work period. Failure to do so breaks the student's registration, and the student must apply for readmission to the undergraduate degree program under whatever conditions and regulations are in effect at that time.

Why Employers Participate in Cooperative Education Programs

Industry and government agencies have found that cooperative students are valuable employees. Generally speaking, they are alert and energetic young people who, stimulated by a definite goal, return more than a day's work for a day's pay. Graduates of the cooperative program represent a good source of well-trained manpower. The training period provides an opportunity for the employer to evaluate the student as a prospective permanent employee. Employers feel that this program is an important part of their effort to attract well-qualified employees. At the same time, the student is able to evaluate the employer in terms of future plans and interests. About half of the cooperative graduates establish such mutually beneficial relationships with their employers that they remain in permanent employment after graduation, with a substantial head start in their careers.

It is emphasized, however, that neither the student nor the employer is obligated for permanent employment after graduation. Industry and government agencies consider participation in cooperative education as a long-range investment rather than a current expense. As a partner with the University, the employer is engaged in a joint effort to develop young talent more fully, thus assuring better education for the student, improved utilization of the graduate, and greater cooperation with the University.

Scholastic Requirements

Students entering the program must be in good academic standing and usually must have completed at least two semesters of college-level academic study prior to their first full-time work assignment. To remain in the program, the student must maintain a passing average and perform satisfactorily for the employer.

Living Accommodations

Arrangements will be made for students in the cooperative program to retain their dormitory and dining privileges at the University, if they so desire, during the work periods. During this time, they will also retain full student privileges and have access to all University facilities. Faculty will be available for consultation by appointment.

Work-Study Schedules

At this time, individual schedules are being arranged with the various employers in Washington and other areas. Since each employer operates differently, special schedules are arranged which are mutually satisfactory to the student, the employer, and the School.

Generally, after the student has successfully completed the first year of study, a schedule is arranged with the employer. Many employers will require the student to work during the summer immediately following the freshman year. The student returns to the School for the sophomore year, working again during the second summer. Beginning with the third year, students alternate between employer and classroom each semester for the next two years, returning to the classroom for the fifth and final year. An alternate method is to work a full academic year and then return to school. Schedules for transfer students are arranged on an individual basis according to the number of credit hours transferred and the employer's requirements.

Tuition Aid

Under the Tuition Aid Program offered by certain employers, up to 50 percent of the cost of tuition, textbooks, and fees (exclusive of room and board) may be granted. If tuition assistance is received, the cooperative student will be required to agree to serve as an employee after graduation for a period to be determined by regulations in effect at that time. As a civil service employee, the co-op student is eligible for many federal benefits, including annual leave, sick leave, paid holidays, health benefits, and life insurance.

Applications

Applications for the Cooperative Education Program from registered or transfer students should be submitted at least ten weeks prior to the beginning of the first work period. It is recommended, however, that applications be submitted at least four months in advance of the work period. Transfer students who meet admission requirements may apply for a work assignment during the summer semester just prior to their registration at this University.

UNDERGRADUATE 3:2 DUAL-DEGREE PROGRAMS COMBINING LIBERAL ARTS AND ENGINEERING

The School of Engineering and Applied Science has developed 3:2 dual-degree programs in Liberal Arts/Engineering with the following accredited four-year degree granting institutions:

Bowie State College, Bowie, Md.
Chestnut Hill College, Philadelphia, Pa.
Georgian Court College, Lakewood, N.J.

Hampton Institute, Hampton, Va.
Hood College, Frederick, Md.
Mansfield State College, Mansfield, Pa.
Marywood College, Scranton, Pa.
St. Joseph's College, Hartford, Conn.
St. Mary's College, St. Mary's City, Md.
St. Thomas Aquinas College, Sparkhill, N.Y.
Virginia Commonwealth University, Richmond, Va.

These programs combine a basic liberal arts, math, and science education with a professional education in engineering in a unique and comprehensive learning experience.

Three:two dual-degree students initially enroll in the program at one of the above institutions and pursue a three-year program covering social sciences, humanities, mathematics, physics, and chemistry, which help the student develop broad cultural perspectives, analytic abilities, and communication skills.

After successful completion of the first phase of study, students then follow a two-year career program in engineering at the School of Engineering and Applied Science. During this phase of the study, students may specialize in any of the following areas of engineering, which are offered in George Washington University's regular four-year programs:

1. Civil Engineering or the following option: Geotechnical Civil Engineering.
2. Electrical Engineering or the following options: Computer Science, Premedical Engineering.
3. Mechanical Engineering or the following options: Computer-oriented Mechanical Engineering, Energy Resources and Power-oriented Mechanical Engineering.
4. Operations Research and Computational Science.

Upon successful completion of the two-year engineering program at George Washington University, students are awarded two baccalaureate degrees: a B.S. or B.A. from the first institution and a B.S. in engineering from George Washington University. At this point the student may choose to enter into engineering practice, continue studies for advanced degrees, or enter other professional areas, such as law, medicine, or teaching.

Dual-degree students are also eligible to apply for the Cooperative Education in Engineering Program at George Washington University (see pp. 44–47). The student transferring to George Washington University will have completed the equivalent of two years of engineering. Thus the student would have the option of working during the summer and starting classes in the fall or working for a full eight months prior to starting classes. Three:two students interested in applying for cooperative education at George Washington University should submit the appropriate application forms one year prior to actual transfer.

While at Hampton Institute, dual-degree students may participate in the Summer Training Program. In this program students may work for a 12-week period during the summer at the Joint Institute for Advancement of Flight Sciences at the National Aeronautics and Space Administration's (NASA) Langley Research Center in Hampton, Va., obtaining valuable work experience in a first-rate laboratory while earning funds for the following academic year. This program may be made available to some pre-freshmen who desire to work upon graduation from secondary school.

For further information on the 3:2 dual-degree programs, contact the Admissions Office of the institutions listed above or Manager, Engineering Admissions, School of Engineering and Applied Science, George Washington University, Washington, D.C. 20052, (202)676-6158.

CONTINUING ENGINEERING EDUCATION PROGRAM

Today most engineers and their employers are well aware of the rapid advances of knowledge in science and technology. The inability to understand and to make timely applications of new technologies can mean both personal and corporate failure. To prevent this potential obsolescence, engineers must involve themselves in a continuing program of technical reading and organized learning.

The School of Engineering and Applied Science meets this need with a comprehensive program of noncredit courses. The program's objective is to increase the competence of practicing engineers rather than to grant further academic degrees. Staff reorganizations require many engineers to change their specialties or to take on additional duties within their present jobs. Continuing engineering education can provide the education and skills the engineer needs to effectively make these changes. Continuing engineering education also aids in qualifying for promotions and in maintaining certification in certain professional fields.

The program will present about 500 noncredit courses this year. About half of them last for five days (30 classroom hours), while others are for two, three, or four days. Some courses are presented in the evening (two-hour sessions once a week for 8 to 12 weeks), or on Saturday morning. Presentation of theory is often augmented by workshops to give registrants practice in the specific discipline. All courses stress practical applications. Students from all over the nation and from many foreign countries have participated in courses. The variety of experience and background of these students enriches the classroom discussions.

January 1980 marked the initiation of a major undertaking to make this program available in Europe at the International Congress Center in Berlin. Twenty-five courses were offered during the first year, using qualified European lecturers when feasible. Those areas of advanced technology in which the United States is a leader will be emphasized.

Subjects which have been presented in the Continuing Engineering Education Program include:

Computers

ADA Computer Programming
ADP Security
ADP Systems Risk Analysis
APT Computer Language and Workshop
Bubble Domain Memory Technology
COBOL Programming
Comparative Data Base Management Systems
Computer-Assisted Makeup and Imaging Systems
Computer-Aided Design/Manufacturing
Computer Cryptography
Computer Communications Systems and Networks
Computer Equipment Registration
Computer Graphics Systems: Design and Applications
Computer Graphics: Hardware and Software
Computer-Aided Circuit Design
Computer Security

Computer Performance Evaluation
Configuration Management of Software Programs
Cryptographic Methods for Data Protection
Data Base Management: Technology and Communication Products
Data Bases for Minicomputers and Networks
Data Compression: Techniques and Applications
Design and Selection of Minicomputer Systems
Designing Data Communication Networks
Designing Human Factors in Computer Graphics
Digital Integrated Circuits
Distributed Information Systems
Distributed Processing: Concepts and Techniques
Embedded Computer Resources
Energy Modeling
Heuristics in Artificial Intelligence
Interactive Computer-aided Circuit Design
Introduction to ADP
Introduction to EDP and CPL
Linear Programming
Local Area Computer Networks
Magnetic Bubble Memory Technology
Microprocessors
Microprocessors and Microcomputers
Microprocessors: Machine Language Programming
Microprocessors and Microcomputers: Theory and APS
Microprocessors and Microcomputers Workshop
Microcomputers in Control Systems
Mini/Microcomputers/Processors for Non-Electrical Engineers
Minicomputer Technology
Modular Software Design
Modern Algorithms for Estimation and Control
Modern Software Development Techniques for Managers
PASCAL Computer Programming
Programming the 6502
Programming the 8080 in Machine and Assembly Languages
Software Design for Data Communication Systems
Software Engineering and Quality Assurance
Software Quality Assurance
Software Reliability Models
Statistical Quality Control for Software Engineering
Standards, Specifications, Codes, and Technical Data
Structured Analysis, Design, and Testing of Computer Systems
Structured Programming and Software Engineering
The Computer Language BASIC
Tools for the Data Analyst
Understanding Computer Hardware and Software
Using Computer-Assisted Instruction in Training
Voice Input-Output: Communications with Machines

Electronics

Advanced Electro-Optics Engineering
Advances in Space Mapping Techniques
Advances in Electronics Technology
Airborne Radar Systems
Air Collision Avoidance Systems Design
Antennas for Radar, Avionics, and Electronic Warfare
Applied Digital Control Systems
Applications of Lasers
Applications of Transport Calculations
Applications of CCD and SAW Devices
Applied ECM
Avionics
Cyclotron Maser
Design and Prediction of Sonar Systems
Design of Digital Control Systems
Digital Filters

Digital Image Processing of Earth Observational Sensor Data
Digital Geographic Information Systems
Digital Electronics for Non-Electrical Engineers
Digital Electronic Switching Systems
Digital Signal Detection and Estimation
ECM and ECCM for Digital Communications
Electro/Fiber Optics and Lasers for Non-Electrical Engineers
Electromagnetic Pulse
Electronic Display Technologies and Applications
Electronic Navigation Systems
Engineering of Very Large Scale Integration (VLSI)
Fiber and Integrated Optics
Fiber Optics Systems Design
Frequency Management
Integrated Circuit Engineering
Intense Charged-Particle Beams
Lightning Protection
Optical Engineering Including Electro-Optics
Physical and Topological Design Concepts for Networks
Radiowave Propagation and Systems Concepts/COMSAT
Radar Fundamentals for Technical Managers
Radar ECCM
Radar Signal Processing and Automatic Detection
Remote Sensing for Global Resource Applications
Solidstate Electronics for Non-Electrical Engineers
Synthetic Aperture Radar with Remote Sensing Applications
Synchronization in Spread Spectrum Systems
TDMA Satellite Systems Engineering
World Trends in Digital Networks, Transmission and Switching

Mathematics/Statistics/Quality Control/Reliability/Safety

Analysis of Variance
Applications of Reliability and Risk Analysis
Aviation Maintenance Management
Aviation Safety Management
Bayesian Statistics for Engineers and Scientists
Case Studies in Reliability
Contingency Tables
Deterministic and Stochastic Control Systems Optimization and Computer Technology
Fault Tree Analysis
Forecasting Techniques
Highway Accident Analysis and Reconstruction
Industrial Safety and Hygiene
Industrial Hazard Identification and Safety Analysis
Japanese Methods for Productivity and Quality
Life Cycle Cost Analysis
Maintainability Engineering
Mathematical Theory of Reliability
Mechanical Reliability
Nonparametric Statistics
Nonlinear Programming
Operations Research
Probability Approach to Fatigue, Crack Growth, and Wear
Quantitative Methods for Management Decision Making
Quality Control Circles
Quality Control Engineering
Quantitative Methods for Criminal Justice Program Planning, Analysis, and Evaluation
Ranking and Selection Procedures
Reliability Testing
Reliability Engineering
Risk Analysis and Control Engineering
Statistical Methods in Reliability
Statistical Methods in Discrete Event Simulation
Stochastic Optimization
Systems Approach to Managing Hospital Risk

System Effectiveness
System Safety
Techniques of Time Series Analysis and Forecasting
Tools for the Data Analyst
Variance Components Estimation
Working Statistics

Management

Advanced Micrographics
Applied Statistical Theory
Applications of Forensic Sciences
Applied Forensics: Questioned Document Examination
Computer Systems for Warehousing/ Distribution
Comparative Information Retrieval Systems
Concepts and Applications of Program Management
Contracting for Services
Configuration Management
Cost Estimating for Managers and Engineers
Data Base Management Essentials
Decision Making and Problem Solving
Developing and Managing Technical Training Programs
Evaluating and Selecting Automated Office Systems
Finance for Engineers
Information Systems Analysis
Information Resource Management
International Management and Marketing Strategy for Engineers and Scientists
Issues Management
Management of Project Documentation
Management of Programs and Projects
Management Skills for Engineers
Management by Objectives
Management Skills for Engineers and Scientists
Microcomputers in the Modern Office
Microfilm Information Systems
Project Management
Project Management and Beyond
Protection of Computer Assets
Public Policy Participation through Issues Management
Records Management
Records Management for Law Enforcement Organizations
Research and Development Management
Specifications and Construction Contracts
The Computer-Micrographics Interface: COM and CAR
Value Engineering/ Analysis
Warehousing: Improved Efficiency through Automation

Materials/Structures/Construction

Advanced Topics in the Finite Element Method
Analysis and Control of Transportation Networks
Analysis and Prevention of Material Failure
Analysis and Design of Concrete Shell Structures
Computer-aided Preliminary Ship Design
Corrosion: Problem Solving
Creep Fracture in Solids
Critical Path Method
Designing for Earthquakes
Dynamic Design of Ocean Structures
Engineering Masonry Design and Construction
Fatigue and Fracture Reliability
Fibrous Composite Structures
The Finite Element Method and Computer Graphics
Fundamentals of Soils Engineering
Geotechnical Instrumentation
Heat Treating: Principles and Applications
Highway Bridges: Inspecting, Rating, and Upgrading
Imminent Revolution and Materials Technology
Increased Productivity Using Queuing Theory
Inelastic Pressure Vessels
Marine Vehicles: Seakeeping and Maneuverability

Metal Fracture and Fatigue
New Bridge Technology
Overflow Modeling and Analysis
Pavement Management: Design, Maintenance, and Rehabilitation
Probability Analysis and Risk/Geotechnical Engineering
Productivity Gains Through Material Handling Innovations
Quality Concrete Production and Construction Control
Railroad Crossties
Railroad Management for Higher Productivity
Railroad Signaling
Railway Bridges: Inspecting, Rating, and Upgrading
Recent Advances in Finite Element Technology
Recent Advances in Structural Models
Recent Developments in Prestressed Concrete Theory
Renovation of Railroad Track and Structures
Resistance and Propulsion of Ships
Roadbed Technology and Railway Track Renovation
Rock Engineering and Underground Construction
Structural Concrete Design
Structural Steel Design
Subsurface Exploration

Medical Engineering/Health Services

Advanced Medical Ultrasound Technology
Biomedical Equipment in Health Care Facilities
Biomedical Applications of Microwave Radiation
Clinical Biochemistry and Pathology
Clinical Engineering Management
Hospital Central Sterile Supply
Hospital Emergency Room Services
Hydrostatic Pressure Vessels
Intensive and Coronary Care Units
Medical and Hospital Control Systems
Neonatal Intensive Care
Outpatient and Day-surgery Center Services
Surgical Operating Suites

Energy

Advanced Pneumatic Control Systems Design
Advances in Solar Photovoltaics
Coal-fired Steam Generation
Cogeneration Systems: Design and Feasibility Analysis
Decision Analysis for Petroleum Exploration
Economics, Rates, and Regulation of Electrical Utilities
Electric Power System Design
Electrical Equipment Maintenance
Electrical Power System Design
Electrical Switchgear Controls and Protective Relaying
Electronic Controls for Industrial and Commercial Power Systems
Energy Forecasting
Energy Efficiency through Cogeneration
Energy Efficient Operation and Design of Buildings
Fluidized-bed Combustion
Forecasting Electricity Demand
Gas Well Testing and Underground Storage of Natural Gas
Grounding, Bonding, and Shielding/Protection of Communications/Electronics
Heat Pipe
Heavy Oil Recovery
Nuclear Energy: A Critical Review for the Nuclear Engineer
Oil Shale Development
Power System Protection
Power System Reliability
Protective Relaying and Switchgear Controls
Reservoir Engineering: Well Testing, Research, and Product Estimation
Solar Heating and Cooling
Spatial Load Forecasting and Power Systems Planning
Temperature Control Systems: Basics of Design

Temperature Control Systems: Calibration and Troubleshooting
Water Recycle and Reuse Systems

Environment

Aerospace Environment: C³I Perspectives
Air Pollution Control Equipment
Applied Oceanography
Design and Control of Turbine Generator Systems
Environmental Law
Environmental Assessment of Water Quality
Geological Hazards in Land Use Planning
Hazard Evaluation of Toxic Substances in Aquatic Ecosystems
Hazardous Wastes Management
Industrial Noise Control
Methodologies for Environmental Impact Studies
Operation and Management of Water Pollution Control Facilities
Preparation of Environmental Impact Statements
Process Design for Wastewater Treatment
Rights of Way and the Environment
Stack Sampling of Air Pollutants
Transportation in the 1980s
Understanding and Controlling Particulate Emissions
Wastewater Engineering
Water Quality Management

General Courses

Applied Geodesy
Effective Writing Workshop
Effective Written Communications
Finding New Products and Managing Their Development
Fixed Asset Analysis
Forensic Geology
Interpersonal Communications for Engineers and Managers
Oral Report Workshop
Packaging and Handling Systems: Engineering Design for Distribution
Report Writing Workshop
Patent Law for Engineers and Scientists
Technology Utilization
Techniques for Standards and Calibrations Laboratories
Technical and Economic Forecasting for Business and Government
Terrain Analysis
Tribiology
Urban Transportation Management
Utilization of the Space Shuttle
Writing Professional and Technical Communications

Communications

Advanced Radar Technology
Antennas
Basics of Military Communications
Cable Television: Technology, Policies, Economics
Command, Control, and Communications
Communications Satellite Engineering
Data Communications Systems and Networks
Data Communications for Managers
Digital Communications Systems
Digital Encoding and Processing of Voice and Video
Digital Signal Processing
Digital Telecommunications
Digital Telephony
Digital Transmission Systems Engineering
Electronic Mail: Technologies and Policy Issues
Electromagnetic Interference and Control
Federal Telecommunications Policy
Fiber Optic and Electro-Optic System Design
Fundamentals of Communications Satellite Systems
Grounding, Bonding, and Shielding
Hazardous Electromagnetic Radiation
Magnetic Recording
Modern Data Communications

Modern Microwave Techniques
Modern Telecommunications
Networks, Antennas, and Radiation
New Technology for the Use of Optics in Radar
Packet Switching
Phase Locked Loops
Protocols for Packet Switching
Radar Signal Processing
Radar Systems and Technology
Radiowave Propagation for Communication Systems Design
Radiowave Propagation in Satellite Communication Systems
Recent Advances and Current Trends in Data Communication
Satellite Communications Processing and Transmission
Satellite Systems for Navigation and Air Traffic Control
Setting Organizational Telecommunications Systems
Sonar Signal Processing
Space Communications and Systems
Spread Spectrum Communication Systems
Switched Telephone Networks: Switching Concepts
Systems Design of Communications Satellites
Telecommunication Product Standards
Telecommunications: Voice and Data
Telephone Equipment Regulation for Voice/Data Interconnection
Telephone Interconnection Systems
Transmission Characteristics of Switched Telephone Networks
U.S. Telecommunications Policy: Implications
Vulnerability of Spread Spectrum Communication Systems
Wide Band Communications Systems

New courses are developed as needs become apparent in various fields, and repeated courses are continuously revised. Over 90 new courses were added last year.

In addition to the faculty of the School of Engineering and Applied Science, outstanding lecturers and instructors from other universities, from industry, and from government laboratories and agencies serve on the instructional staff of the program.

The program also offers noncredit contract courses off campus specifically tailored for the needs and background of the engineers employed by a company or agency. Tuition for these courses is usually slightly lower than for those offered at the University.

To receive announcements or additional information on the program, write to Continuing Engineering Education Program, School of Engineering and Applied Science, George Washington University, Washington, D.C. 20052, or call (202) 676-6106 or (800) 424-9773.

Administration

Harold Liebowitz, D.Ae.E., *Dean of the School of Engineering and Applied Science; Co-director of the Joint Institute for Advancement of Flight Sciences; Director, Institute for the Study of Fatigue, Fracture, and Structural Reliability*

Professor Elmer Feir, Ph.D., *Associate Dean of the School of Engineering and Applied Science*

Professor Matthew Gilmore, Ph.D., *Chairman of the Department of Civil, Mechanical, and Environmental Engineering*

Donald Gross, Ph.D., *Chairman of the Department of Operations Research*

Arthur D. Friedman, Ph.D., *Chairman of the Department of Electrical Engineering and Computer Science*

Sam Rothman, Ph.D., *Chairman of the Department of Engineering Administration*

William H. Marlow, Ph.D., *Director, Institute for Management Science and Engineering*

Walter Kurt Kahn, D.E.E., *Acting Director, Institute for Information Science and Technology*

Vujica Yevjevich, D.Eng., *Director, International Water Resources Institute*

Nozer Darabsha Singpurwalla, Ph.D., *Director, Institute for Reliability and Risk Analysis*

Robert Heath Tolson, M.S., *Chief Scientist, NASA-Langley Research Center; Director of the Joint Institute for Advancement of Flight Sciences*

Shao Wen Yuan, Ph.D., *Associate Director, Joint Institute for Advancement of Flight Sciences*

Malcolm P. Clark, M.S., *Administrator of the NASA-Langley Graduate Program*

John Lindsey Whitesides, Jr., Ph.D., *Assistant Director, Research and Education, Joint Institute for Advancement of Flight Sciences*

J.W. Perkins, B.S., *Director of the Continuing Engineering Education Program*

Graham W. McIntyre, M.S., *Director, Research and Resources Office*

William F. Shanahan, M.E.A., *Manager of Engineering Admissions and Cooperative Education Program*

DEAN'S COUNCIL

Harold Liebowitz *(Chairman)*, R.R. Fox, T.G. Toridis, Henry Steiner

Advisory Council*

The purposes of the Advisory Council for the School of Engineering and Applied Science are to strengthen communication between the School and the other colleges, schools, and divisions of the University as well as between the School and the University's Board of Trustees; to advise on the programs of instruction, research, and service in the School and to help interpret these programs to the community and the nation; and to stimulate support for the continued development of the School and its programs.

MEMBERS OF THE COUNCIL FOR 1981–82

Chairman: Stephen R. Woodzell *(University Trustee), former President of the Potomac Electric Power Company*

Raymond L. Bisplinghoff, *Tyco Laboratory*

* The President of the University, the Vice President for Academic Affairs, and the Dean of the School of Engineering and Applied Science are *ex officio* members of the Advisory Council.

Bruno A. Boley, *Dean, Technological Institute, Northwestern University*
George M. Bunker, *President, Martin Marietta Corporation*
P. Chambers, *President, Melpar Division E-Systems, Inc.*
Stanley Crane, *Chairman and Chief Executive Officer, Consolidated Rail Corporation*
Joseph M. Fox, *Chairman, Lesco/Fox Associates, Inc.*
Moses Freedman, *Vice President, Blake Construction Company*
Eugene G. Fubini, *Engineering Consultant*
Martin Goland, *President, Southwest Research Institute*
William J. Harris, Jr., *Vice President, Research and Test Department, Association of American Railroads*
Alexander Hassan, *Washington, D.C.*
Walter R. Hibbard, Jr., *Professor, Virginia Polytechnic Institute, Blacksburg*
William Holt, *Carborundum Company, Niagara Falls, N.Y.*
William H. Marlow, *Professor, Department of Operations Research*
Coleman Raphael, *President, Atlantic Research*
Bernard A. Schriever, General USAF (Ret.), *Chairman of the Board, Schriever & McKee Associates, Inc.*
Wayne G. Shaffer, *President, Vitro Corporation*
Edward G. Uhl, *Chairman of the Board, Fairchild Industries, Inc.*
Ernst Weber, *Chairman, Division of Engineering, National Research Council*
Harold A. Wheeler, *Chief Scientist and Chairman, Hazeltine Corporation*
James F. Young, *Vice President—Engineering, General Electric Company*
L. A. Zadeh, *Chairman, Department of Electrical Engineering and Computer Sciences, University of California, Berkeley*



PROGRAMS OF STUDY AND COURSES OF INSTRUCTION

On the following pages are listed programs of study, curricula, and courses of instruction offered by the School of Engineering and Applied Science.

Students who are not candidates for degrees but who wish to take courses offered by the School should apply for admission to the Division of Continuing Education and Summer Sessions.

EXPLANATION OF COURSE NUMBERS

Courses numbered from 1 through 199 are planned for undergraduate credit although certain courses may be taken for graduate credit when arrangements are approved in advance by the instructor and the Dean. Courses numbered 201 to 300 are planned for graduate credit and may in certain instances be taken by qualified undergraduate students. Courses numbered from 301 to 400 are primarily for doctoral students.

SEMESTER HOURS OF CREDIT

The number of semester hours' credit given for the satisfactory completion of a course is indicated in parentheses after the name of the course. Thus, a year course giving three hours of credit each semester is marked (3–3), and a semester course giving three hours' credit is marked (3). A semester hour consists of the completion of one 50-minute period of class work or of one laboratory period a week for one semester.

TIME OF COURSE OFFERINGS

Following each course description is a parenthetical statement listing the semester for which the course is scheduled to be offered. The term "academic year" is used only with two-semester courses, and indicates that the first half of the course is to be offered in the fall semester and the second half in the spring semester; the term "as arranged" is used for courses which could not be scheduled at the time of printing this catalogue. Offerings for the summer sessions are not designated in this catalogue. Students should consult the *Summer Sessions Schedule of Classes* for summer offerings. A *Schedule of Classes* is also published for each fall and spring semester which provides up-to-date information concerning the time of course offerings.

KEY TO ABBREVIATIONS

The following abbreviations for course designations are used by George Washington University.

Acct	Accounting
AmCv	American Civilization
Anat	Anatomy
Anes	Anesthesiology
Anth	Anthropology
ApSc	Applied Science
Art	Art
ArTh	Art Therapy
Bioc	Biochemistry
BiSc	Biological Sciences
BAd	Business Administration
Cart	Cartography
Chem	Chemistry
CH&D	Child Health and Development
Chin	Chinese
CE	Civil Engineering
Clas	Classics
ClEn	Clinical Engineering
CSci	Computer Science
Derm	Dermatology
Econ	Economics
Educ	Education
EPol	Education Policy
EE	Electrical Engineering
EAd	Engineering Administration
EngS	Engineering Science
Engl	English
EFL	English as a Foreign Language
EnHe	Environmental Health
Envr	Environmental Studies
Hum	Experimental Humanities
ForS	Forensic Sciences
Fren	French
Genet	Genetics
Geob	Geobiology
Geod	Geodesy
Geog	Geography and Regional Science
Geol	Geology
Ger	Germanic Languages and Literatures
Gero	Gerontology
HCS	Health Care Sciences
HSA	Health Services Administration
Hist	History
HKLS	Human Kinetics and Leisure Studies
Idis	Interdisciplinary Courses
IAf	International Affairs
Ital	Italian
Japn	Japanese
Jour	Journalism
Law	Law
Mgt	Management Science
Math	Mathematics
ME	Mechanical Engineering
M&PA	Medical and Public Affairs
Med	Medicine
Micr	Microbiology
MStd	Museum Studies
Mus	Music
NSur	Neurological Surgery
Neur	Neurology
Ob&G	Obstetrics and Gynecology
Ocea	Oceanography
OR	Operations Research
Opth	Ophthalmology
Oral	Oral Biology
Orth	Orthopedic Surgery
Otol	Otolaryngology
Path	Pathology
Phar	Pharmacology
Phil	Philosophy
Phys	Physics
Phyl	Physiology
PCm	Political Communications
PSc	Political Science
Port	Portuguese
Pchi	Psychiatry and Behavioral Sciences
Psyc	Psychology
PAd	Public Administration
RSci	Radiological Sciences
Rad	Radiology
RPol	Regulatory Policy
Rel	Religion
SLP	Service Learning Program
Slav	Slavic Languages and Literatures
Soc	Sociology
Span	Spanish
SpEd	Special Education
SpDr	Speech and Drama
Stat	Statistics
Surg	Surgery
TCom	Telecommunication Operations
Univ	University
U&RP	Urban and Regional Planning
Urol	Urology
WStu	Women's Studies

Applied Science

Interdepartmental offerings.

UNDERGRADUATE COURSES

57 Analytical Mechanics I (2)
First half of a one-year sequence. Concepts of statics, including force systems, equilibrium conditions, simple structures, distributed forces, shear and moments, friction and the concept of work, virtual work and stability. Prerequisite or concurrent registration: ApSc 113, Phys 14. (Fall and spring)

58 Analytical Mechanics II (3)
Second half of a one-year sequence. Concepts of dynamics, including kinematics of particles, velocity and acceleration, Newton's laws of motion, momentum, work, kinetic energy, potential energy, central force fields, vibrations, resonance, dynamics of systems of particles, kinematics of a rigid body, dynamics of a rigid body. Prerequisite: ApSc 57. (Fall and spring)

113 Engineering Analysis I (3)
Analytical methods appropriate to the solution of engineering problems, including applications of ordinary differential equations, matrices and determinants, eigenvalues and eigenvectors, systems of ordinary linear differential equations, Bessel and Legendre functions. Prerequisite: Math 33. (Fall and spring)

114 Engineering Analysis II (3)
Analytical methods appropriate to the solution of engineering problems, including complex variables, Fourier series and integral, orthogonal functions, Laplace transforms, partial differential equations in engineering and applied science. Prerequisite: ApSc 113. (Fall and spring)

115 Engineering Analysis III (3)
Solution of engineering problems using concepts from probability and statistics, including random variables, distribution functions, mathematical expectation, point and confidence interval estimation, hypothesis testing, correlation, and regression. This methodology applied to problems of structural design, bioengineering, manufacturing processes, product quality, equipment reliability, engineering management, and societal engineering. Prerequisite: Math 31. (Fall and spring)

116 Engineering Analysis IV (3)
Solution of engineering problems using advanced concepts from probability and statistics applied to problems of engineering design, bioengineering, production processes, engineering management, and societal engineering. Prerequisite: ApSc 115 and Math 33. (Fall and spring)

199 Honors Research Project and Seminar (3)
The student designs and carries out a research project under the close supervision of a faculty adviser. Students from all engineering disciplines meet periodically in a seminar to present their projects and discuss results with their peers. Enrollment is limited to those students admitted to the SEAS Undergraduate Honors Research Program.

GRADUATE COURSES

211 Analytical Methods in Engineering I (3)
Engineering applications of the theory of complex variables including contour integration, conformal mapping, inversion integral, and boundary-value problems. Prerequisite: approval of Department. (Fall and spring)

212 Analytical Methods in Engineering II (3)
Analytical methods appropriate to the formulation of engineering problems including finite dimensional vector spaces, eigenvalue problems, generalized Fourier series, tensor calculus, curvilinear coordinates. Prerequisite: approval of Department. (Fall)

213 Analytical Methods in Engineering III (3)
Analytical techniques for solution of boundary-initial value problems in engineering involving wave propagation, diffusion processes, and potential distributions. Prerequisite: approval of Department. (Fall and spring)

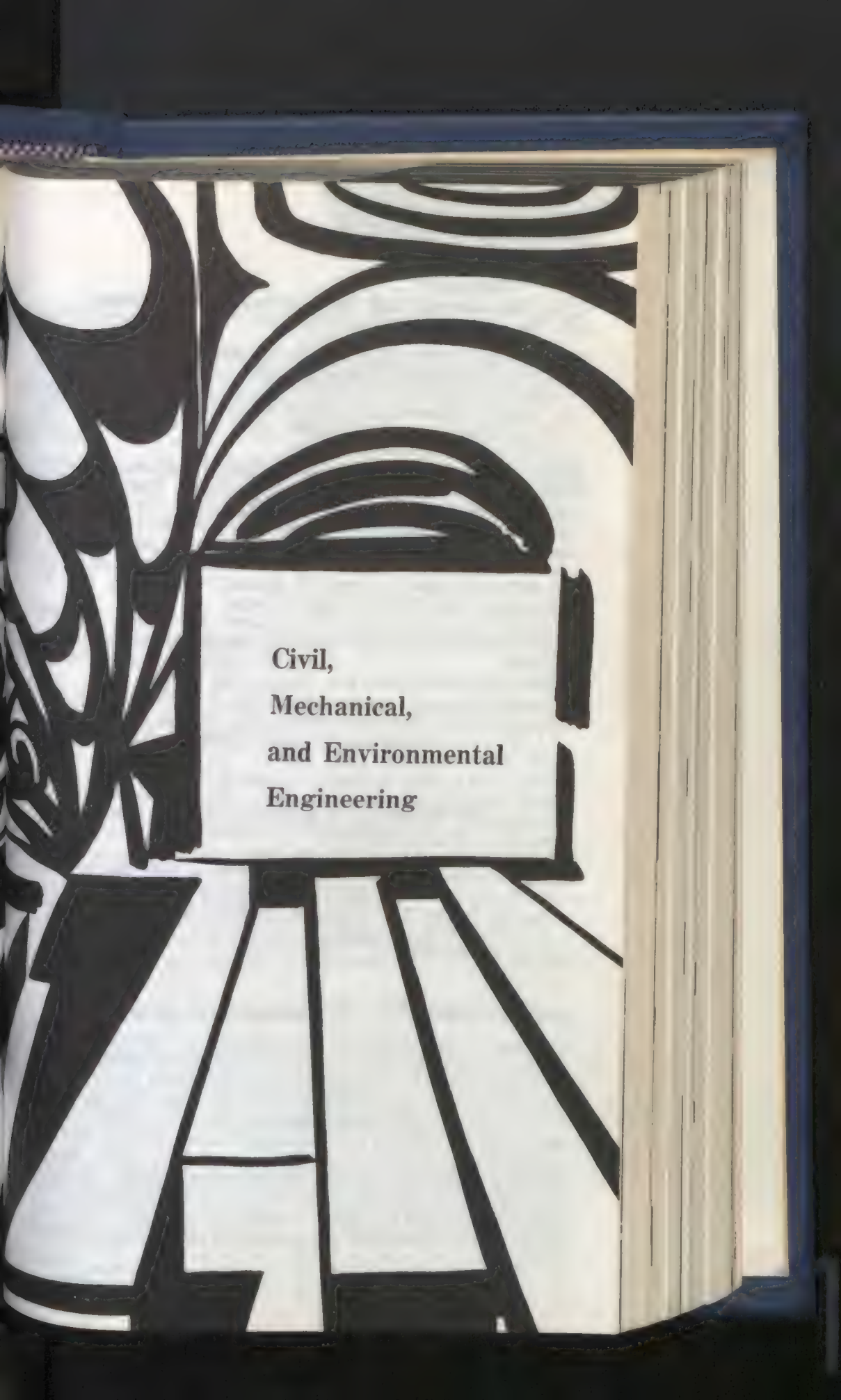
214 Analytical Methods in Engineering IV (3)
Introduction to variational methods in engineering including Ritz and Galerkin approximation methods of boundary-value problems. Aspects of linear integral equations arising from engineering analysis. Prerequisite: approval of Department. (Spring)

215 Analytical Methods in Engineering V (3)
Advanced methods of solution of boundary-initial value problems in engineering, including characteristics, wave propagation, and Green's functions. Prerequisite: ApSc 213. (Fall)

216 Special Topics in Engineering Analysis (3)
Selected topics such as (1) perturbation techniques applied to approximate solution of nonlinear boundary and initial value problems in engineering; (2) application of singular integral equations in problems of mechanics; (3) applications of elements of functional analysis in engineering and science. Prerequisite: approval of Department. (Spring, even years)



KOUROS


Civil,
Mechanical,
and Environmental
Engineering

Civil, Mechanical, and Environmental Engineering

Professors G.M. Arkilic, R.R. Fox, H. Liebowitz, S.W. Yuan, J.E. Feir, T.G. Toridis, J.P. Campbell *(Research)*, J. Eftis, A.K. Noor, R. Goulard, A.B. Cambel, K. Mahmood, A.M. Kiper, M.K. Myers, J-N. Yang, R.E. Kaufman, V. Yevjevich *(Research)*, A. Radkowsky *(Research)*, D.M. Esterling, C.M. Gilmore *(Chairman)*, J.L. Whitesides, Jr., T.P.G. Liverman, V. Klein *(Research)*, D.L. Jones, B. Bell

Adjunct Professors R.M. Sorensen, W.P. Reid, M.P. Gaus, Y. Gordon

Professorial Lecturers R.E. Fulton, M.J. Queijo, J.B. Scalzi, L.K. Loftin, Jr., L. Divone, L.G. Herman, M. Yachnis, W. Viessman, Jr., K.H. Jones, W.D. Erickson, J.A. Belding, Jr., N.L. Basdekas, B. Whang, M.S. Ojalvo, J. Weggel, T-F. Zien, D. Michel, A. Koth, D.R. Levin, A. Adamantiades, G. Banerian, H. Goldsmith, W.L. Harris, W.D. Jackson, H.H. Landon, G.D. Love, B. Miller, S-C. Liu, C.J. Astill, S. Buckser, W.H. Huang, P.D. Maycock, G.K. Lea, J. Sobieski, J.C. Hardin, D. Gubser

Associate Professors H. Runyan, Jr. *(Research)*, M.M. Hafez *(Research)*, C.A. Garris, A. Goicoechea *(Research)*, P.K. Poulose *(Research)*, I.S. Raju *(Research)*

Adjunct Associate Professors B.W. Hannah, A.K. Trehan

Associate Professorial Lecturers R.W. Fralich, E.C. Yates, Jr., M. Stein, R.W. Barnwell, T.M. Walsh, E.F. Skelton, H.A. Leybold, J. Ettinger, E. Glynn, P.L. Coe, Jr., C.J. Jachimowski, M.C. Cullingford, D. Feit, R. McConnell, D.R. Tenney, H.S. Lew, A.M. Yen, J.C. Yu, R.Y. Ting, A. Kehnemui, E. Long, Jr., S.K. Park, H. Singh, W. Kenis, D. Ellison, P. Boon, R.M. Brown, M.O. Critchfield, C. Ng, B.P. Shah, F.L. Willingham, Jr., H.I. Abelson, F. Farassat, S.T. Hwang, S.C. Mehrotra, M.S. Nataraja, L-S. Pan, A.B. Wardlaw, Jr., C. Wu, K. Khozeimeh

Assistant Professor R.K. Kurzega *(Research)*

Assistant Professorial Lecturers R.L. Bowles, D. Mulville, W.J. Boettinger, H.L. Beach, Jr., D.D. Loendorf, G.D. Walberg, D.L. Dwoyer, B.A. Stein, M. Furman, R. Lee, T.L. Walton, Jr., J. Tracy, G.E. Hicho, M.Y. Hussaini, R.C. Swanson, Jr., M. Mikulas

Lecturer K. Steinhaus

CIVIL ENGINEERING—UNDERGRADUATE STUDY

Civil engineering encompasses those branches of engineering activities most closely related to the control and improvement of our environment and of the conditions of life. Study in this field prepares students for careers in the planning, design, and construction of buildings; bridges; roads; airports; rapid transportation systems; harbors; off-shore facilities; coastal protection structures; flood and pollution control systems for rivers, estuaries, and lakes; inland navigation systems; large power generation and flood control dams; water resources projects; urban renewal and development projects; and pollution control and waste disposal projects. It also provides the scientific and technological background required for careers in municipal engineering, urban and regional planning, and environmental and geotechnical civil engineering; and for careers

engineering research in structural mechanics, ocean engineering, and materials engineering.

The curriculum provides the essentials for beginning a career upon graduation, for registration as a professional civil engineer as required by law, and for continuing study at the graduate level.

ening Classes

response to requests from those employed full time in the Washington, D.C., a who wish to obtain a Bachelor of Science degree in Civil Engineering in easonable period of time, evening classes in the Civil Engineering curricu- are scheduled on a regular basis. For example, if a part-time student en- s for three courses a semester, B.S. degree requirements can be completed ess than 15 semesters.

e Curriculum

rmally the first four semesters are common to all undergraduate fields in the hool of Engineering and Applied Science.

First Semester

EE 51: Applications of Computers (3)
Math 30–31: Precalculus and Single-Variable Calculus I (3)*
or
Math 31: Single-Variable Calculus I (3)
Phys 3: Foundations of Physics (3)
Engl 9 or 10: English Composition: Language as Communication (3)
Elective: Selected from humanities or social sciences (3)

Second Semester

EngS 4: Descriptive Geometry and Drafting (3)
Math 32: Single-Variable Calculus II (3)†
Math 33: Multivariate Calculus (3)†
Phys 14: Introductory Mechanics and Thermal Physics (3)
Elective: Selected from humanities or social sciences (3)

Third Semester

ApSc 57: Analytical Mechanics I (2)
ApSc 113: Engineering Analysis I (3)
ApSc 115: Engineering Analysis III (3)
Chem 13: General Chemistry (4)
Phys 15: Elements of Electricity and Magnetism (3)
Elective: Selected from humanities or social sciences (3)
(May be taken during the Summer Sessions)

*Transfer students who have not successfully completed a college-level calculus course with a grade of C or better from an accredited institution, or high school students who did not take an advanced placement (AP) calculus course and receive a score of 4 or 5 on the AP test, will be required to take a one hour locally administered math placement test at registration. This test covers algebra, trigonometry, and graphs. Students who do not place directly into Math 31 as a result of this test will be required to undertake a combined pre-calculus and calculus course (Math 30–31) during their first semester; this combined course meets five hours per week and carries three semester hours of credit. If the student successfully completes the second half (Math 31) of the combined course.

†Math 32 and Math 33 may be taken in a one-semester combined course, Math 32–33.

Fourth Semester

ApSc 58:	Analytical Mechanics II (3)
ApSc 114:	Engineering Analysis II (3)
CE 120:	Introduction to Mechanics of Solids (3)
CE 140:	Materials Science (3)
Phys 16:	Introduction to Modern Physics (3)

Civil Engineering Curriculum

Fifth Semester

CE 110:	Introduction to Environmental Engineering (3)
CE 121:	Structural Theory I (3)
CE 166:	Materials Engineering (2)
CE 167:	Mechanics of Materials Laboratory (1)
ME 131:	Thermodynamics (3)
Elective:	Selected from humanities or social sciences (6)

Sixth Semester

CE 122:	Structural Theory II (3)
CE 190:	Legal and Economic Aspects of Engineering (2)
CE 192:	Reinforced Concrete Structures (3)
Geol 136:	Engineering Geology (3)
ME 126:	Fluid Mechanics (3)
Elective:	Selected from humanities or social sciences (3)

Seventh Semester

CE 168:	Introductory Soil Mechanics (3)
CE 191:	Metal Structures (3)
CE 193:	Hydraulics (3)
CE 194:	Environmental Engineering I: Water Supply and Resources (3)
CE 195:	Hydrology (3)
Elective:	Technical electives (3)

Eighth Semester

CE 182:	Foundation Engineering (2)
CE 185:	Soil Mechanics and Foundation Engineering Laboratory (1)
CE 196:	Design and Cost Analysis of Civil Engineering Structures (3)
CE 197:	Environmental Engineering II: Waste and Pollution Control (3)
Elective:	Technical electives (5)

Technical Electives

CE 198:	Research (3)
CE 201:	Design of Metal Structures (3)
CE 202:	Design of Reinforced Concrete Structures (3)
CE 203:	Prestressed Concrete Structures (3)
CE 204:	Applied Soil Mechanics I (3)
CE 206:	Foundation Engineering (3)

CE 208: Rock Mechanics (3)
CE 210: Methods of Structural Analysis (3)
CE 212: Open Channel Flow (3)
CE 213: Hydraulic Structures (3)
CE 214: Design of Dams (3)
CE 215: Urban Construction Technology (3)
CE 216: Advanced Hydrology (3)
CE 220: Urban Transportation Engineering (3)
CE 222: Stations and Terminals (3)
CE 223: Traffic Engineering (3)
CE 240: Environmental Microbiology (3)
CE 241: Environmental Chemistry (3)
CE 243: Environmental Impact Assessment (3)
CE 253: Failure and Reliability Analysis of Engineering Structures (3)
CE 255: Coastal Processes (3)
CE 266: Design Procedures for Earthquakes (3)
CE 282: Hydraulic Modeling (3)
EAd 150: Introduction to Engineering Administration (3)
EngS 215: Advanced Strength of Materials (3)
EngS 229: Transformations in Materials (3)
EngS 230: Deformation of Materials (3)
EngS 231: Structure of Materials (3)
EngS 234: Composite Materials (3)
EngS 237: Environmental Effects on Materials (3)
EngS 241: Failure of Materials (3)
EngS 242: Materials Recycling and Recovery (3)
EngS 282: Computer-aided Design (3)
EngS 284: Numerical Methods in Engineering (3)



Geotechnical Civil Engineering Option

Geotechnical civil engineering encompasses engineering problems involvin soil mechanics, foundation engineering, rock mechanics, and geological as pects of engineering. More specifically, planning, designing, and erecting struc tures founded on or made of soil and rock constitute the main features of thi branch of civil engineering. Included are the design and construction of founda tions for all types of buildings, bridges, and highway and airfield pavements design and construction of earth- and rock-fill dams, embankments, waterfron structures, tunnels, and drainage facilities; and stabilization procedures fo reclamation of marginal lands. Engineering geology, which is the application o geological data, principles, and interpretations to naturally occurring earth an rock masses, constitutes an important part in the planning and design stages o civil engineering structures of the above type. The Geotechnical Civil Engineer ing Option provides the student with the fundamentals for subsequent growt and development in this branch of civil engineering.

CURRICULUM

Prerequisite: first four semesters as described in the Core Curriculum, se pages 65–66 with the following changes:

Third semester: *Geology 21 *Physical and Evolutionary Geology* will b taken instead of the elective.

Fourth semester: *Geology 122 *Structural Geology* will be taken instead o CE 120: *Introduction to the Mechanics of Solids.* A 3-credit elective in th social sciences or humanities should also be taken at this time.

	Fifth Semester
CE 120:	Introduction to the Mechanics of Solids (3)
CE 121:	Structural Theory I (3)
ME 131:	Thermodynamics (3)
CE 166:	Materials Engineering (2)
CE 167:	Mechanics of Materials Laboratory (1)
Elective:	Selected from humanities or social sciences (3)
	Sixth Semester
CE 122:	Structural Theory II (3)
ME 126:	Fluid Mechanics (3)
CE 190:	Legal and Economic Aspects of Engineering (2)
CE 192:	Reinforced Concrete Structures (3)
*Geol 128:	Geomorphology (3)
*Geol 136:	Engineering Geology (3)
	Seventh Semester
CE 168:	Introductory Soil Mechanics (3)
CE 191:	Metal Structures (3)
CE 193:	Hydraulics (3)
CE 195:	Hydrology (3)
*Geol 163:	Sedimentation (4)
*Geol 189:	Geophysics for Geologists (3)

* For course descriptions, see the *Undergraduate and Graduate Bulletin.*

Eighth Semester

CE 182:	Foundation Engineering (2)
CE 185:	Soil Mechanics and Foundation Engineering Laboratory (1)
CE 204:	Applied Soil Mechanics I (3)
*Geol 195:	Field Work (2)
Electives:	Selected from humanities or social sciences (6)

Civil Engineering Undergraduate Courses

110 Introduction to Environmental Engineering (3)
An introductory study of environmental resources and their uses. Aspects considered will include water resource systems; air and water quality; solid waste and wastewater disposal systems; noise pollution; treatment processes; environmental impact analysis and environmental planning. Prerequisite: Chem 13. (Fall)

120 Introduction to the Mechanics of Solids (3)
Stress and strain, axial load problems; torsion; shear force and bending moment; pure bending of beams; shearing stresses in beams; compound stresses; analysis of plane stress and plane strain; combined stresses; deflection of beams; statically indeterminate problems; columns; the energy methods. Prerequisite: ApSc 57, 113. (Fall and Spring)

121–22 Structural Theory I-II (3–3)
Theory of determinate and indeterminate structures using both classical and modern approaches. Prerequisite or concurrent registration: CE 120. (Fall and spring)

140 Materials Science (3)
Electron structure of atoms; atomic and molecular bonding; energy bands; crystal structure; imperfections; noncrystalline solids; reaction rates; diffusion; transport phenomena—thermal conductivity, electrical conduction; metals, insulators, semiconductors; magnetism. Prerequisite: Chem 13; concurrent registration: Phys 16. (Fall and spring)

166 Materials Engineering (2)
Mechanical properties and their description; effect of microstructure on the mechanical behavior of metals, ceramics, polymers, and polyphase materials; effect of strain-rate and temperature; creep, fatigue, and fracture; effect of surface and environment; materials evaluation for structural performance. Prerequisite: CE 140; concurrent registration: CE 120. (Fall and spring)

167 Mechanics of Materials Laboratory (1)
Measurement of strains and study of failure resulting from applied forces in ductile, brittle, anisotropic, elastomeric, plastic, and composite materials. Study of tension, compression, bending, impact and shear failures. Prerequisite or concurrent registration: CE 166. (Fall and spring)

168 Introductory Soil Mechanics (3)
Engineering properties of soils; analysis of lateral earth pressures, bearing capacity, foundations, and slope stability. Prerequisite: CE 120, ME 126. (Fall)

182 Foundation Engineering (2)
Subsurface exploration, design of shallow foundations, design of pile foundations, earth-retaining structures. Prerequisite: CE 168. (Spring)

*For course descriptions, see the *Undergraduate and Graduate Bulletin*.

185 **Soil Mechanics and Foundation Engineering Laboratory** (1)
Laboratory experiments for the classification, strength, compressibility, and general engineering properties of soils. Prerequisite: CE 168. (Spring)

190 **Legal and Economic Aspects of Engineering** (2)
Laws relating to engineering practice, preparation of contract documents and specifications, consideration of economic factors in engineering design decisions. (Spring)

191 **Metal Structures** (3)
Principles of the design of metal structures; structural elements; connections; specific problems of analysis; methods of construction. Prerequisite: CE 122. (Fall)

192 **Reinforced Concrete Structures** (3)
Principles of the design of reinforced concrete structures. Details of reinforcement of structural elements. Monolithic structures, precast elements, methods of construction. Prerequisite: CE 121. (Spring)

193 **Hydraulics** (3)
Fluid statics: applications to calculation of boundary forces in a static fluid, buoyancy, and flotation. Application of kinematic principles; flow fields, stream tubes, and flow nets. Fluid dynamics: applications to pipe flow, hydraulic models, measurement of pressure, and velocity. Open channel flow: applications to water resources engineering. Prerequisite: ME 126. (Fall)

194 **Environmental Engineering I: Water Supply and Resources** (3)
Planning and design of water supply and waste-water disposal systems. Water quality control and treatment processes. Desalination, stream pollution control. Prerequisite or concurrent registration: CE 193. (Fall)

195 **Hydrology** (3)
Descriptive hydrology: hydrologic cycle, precipitation, stream flow, evaporation, and transpiration. Quantitative hydrology: hydrograph analysis, estimating volume of runoff, runoff from snow, hydrographs of basin outflow, storage routing. Probability concepts in hydrology: flood frequency, rainfall frequency, drought, stochastic hydrology. Prerequisite or concurrent registration: ApSc 115, ME 126, CE 193. (Fall)

196 **Design and Cost Analysis of Civil Engineering Structures** (3)
Design of civil engineering structures such as wharves, piers, bulkheads, tunnels, dams, bridges, water treatment, and drainage systems. Prerequisite: senior status. (Spring)

197 **Environmental Engineering II: Waste and Pollution Control** (3)
Disposal of sewage, biological treatment, chemical treatment, filtration, activated sludge, sludge handling and disposal. Control of industrial wastes and of nuclear waste products. Solid waste disposal. Prerequisite CE 193. (Spring)

198 **Research** (1 to 3)
Applied research and experimentation projects, as arranged. Prerequisite junior or senior status. (Fall and spring)

MECHANICAL ENGINEERING—UNDERGRADUATE STUDY

Mechanical engineering is primarily concerned with physical systems in motion. A mechanical engineer is concerned with the conversion, transfer, and control of energy from its source to its moving system. Land and marine ve-

cles, transportation systems, air-conditioning systems, nuclear reactors and
el cells, low-pollution control devices, synthetic fuels, energy resources and
e means of practical and economical conversion of the various forms of en-
gy to mechanical and electrical power, and a host of other devices lie in this
omain. Training in this area should provide the ability to formulate problems
sed on fundamental laws of nature, to recognize the types of methods which
e applicable to their solution, to read with understanding the relevant work,
d to come up with a usable answer. The mechanical engineering curriculum
ovides a background for careers in research, design, development, and manu-
ture in a wide variety of industries.

Course offerings in mechanical engineering, which begin with a broad
undation in physics, chemistry, mathematics, humanities, and social sciences,
nsist of studies in basic mechanics of solids and fluids, electricity and
ctronics, material sciences, dynamic analysis, thermal sciences, energy con-
sion and power, environmental control, and the design of machines and
stems and their control. Technical electives in the senior year allow students
erested in computers to select an option which will prepare them for careers
computing as well as graduate study in computer-dominated or computer-
ented professional fields. The program outlined below is based on the con-
t that the mechanical engineer must be prepared to meet the challenge of
-increasing technical, economic, and social problems.

Graduates are qualified for professional positions in design, analysis, manu-
ture, and application of machines, process, and control, or in research and
elopment, as well as for graduate work.

ning Classes

esponse to requests from those employed full time in the Washington, D.C.,
a who wish to obtain a Bachelor of Science degree in Mechanical Engineer-
n a reasonable period of time, evening classes in the Mechanical Engineer-
curriculum are scheduled on a regular basis. For example, if a part-time
dent enrolls for three courses a semester, B.S. degree requirements can be
pleted in less than 15 semesters.

ior Year Abroad Program

e School of Engineering and Applied Science and the Institute of Sound and
ation Research of the University of Southampton, England, have estab-
an exchange program so that graduate students in acoustics at both insti-
ns may transfer academic credits to either University in fulfillment of the
irements for advanced degrees. A special arrangement has now been made
tend the graduate exchange program to the undergraduate level, enabling
e mechanical engineering students to spend the junior year abroad.
e program furthers a student's particular academic interests in mechanical
neering and develops knowledge of world affairs in general, and inter-
al technical fields in particular.
Applicants must apply for admission to the Junior Year Abroad program to
Department Chairman before the end of the fall semester of the sophomore
. Approval must be given by the Department Chairman and the Dean of
School of Engineering and Applied Science.

Core Curriculum

Normally the first four semesters are common to all undergraduate fields in the School of Engineering and Applied Science.

First Semester

EE 51:	Applications of Computers (3)
Math 30–31:	Precalculus and Single-Variable Calculus I (3)*
or	
Math 31:	Single-Variable Calculus I (3)
Phys 3:	Foundations of Physics (3)
Engl 9 or 10:	English Composition: Language as Communication (3)
Elective:	Selected from humanities or social sciences (3)

Second Semester

EngS 4:	Descriptive Geometry and Drafting (3)
Math 32:	Single-Variable Calculus II (3)†
Math 33:	Multivariate Calculus (3)†
Phys 14:	Introductory Mechanics and Thermal Physics (3)
Elective:	Selected from humanities or social sciences (3)

Third Semester

ApSc 57:	Analytical Mechanics I (2)
ApSc 113:	Engineering Analysis I (3)
ApSc 115:	Engineering Analysis III (3)
Chem 13:	General Chemistry (4)
Phys 15:	Elements of Electricity and Magnetism (3)
Elective:	Selected from humanities or social sciences (3) (May be taken during the Summer Sessions)

Fourth Semester

ApSc 58:	Analytical Mechanics II (3)
ApSc 114:	Engineering Analysis II (3)
CE 140:	Materials Science (3)
EE 11:	Linear Networks I (3)
Phys 16:	Introduction to Modern Physics (3)
Elective:	Selected from humanities or social sciences (3) (May be taken during the Summer Sessions)

Mechanical Engineering Curriculum

Fifth Semester

CE 120:	Introduction to the Mechanics of Solids (3)
CE 166:	Materials Engineering (2)
CE 167:	Mechanics of Materials Laboratory (1)
ME 131:	Thermodynamics (3)
ME 134:	Introduction to Vibration Analysis (3)
Elective:	Selected from humanities or social sciences (3)

* Transfer students who have not successfully completed a college-level calculus course with a grade of *C* or better from an accredited institution, or high school students who did not take an advanced placement (AP) calculus course and receive a score of 4 or 5 on the AP test, will be required to take a one-hour locally administered math placement test at registration. This test covers algebra, trigonometry, and graphs. Students who do not place directly into Math 31 as a result of this test will be required to undertake a combined pre-calculus and calculus course (Math 30-31) during their first semester; this combined course meets five hours per week and carries three semester hours of credit if the student successfully completes the second half (Math 31) of the combined course.

† Math 32 and Math 33 may be taken in a one-semester combined course, Math 32–33.

Sixth Semester

EE 20: Introductory Engineering Electronics (3)
EE 172: Control Systems (3)
ME 120: Methods of Engineering Experimentation (2)
ME 126: Fluid Mechanics (3)
ME 148: Thermodynamic Analysis (3)
Elective: Selected from humanities or social sciences (3)

Seventh Semester

ME 155: Compressible Fluid Flow (3)
ME 187: Heat Transfer Theory (3)
ME 190: Mechanisms, Analysis, and Synthesis (3)
ME 191: Mechanical Design (3)
Elective: Technical electives (6)

Eighth Semester

ME 152: Mechanical Engineering Laboratory (2)
ME 193: Engineering Systems Design (3)
ME 194: Energy Conversion (3)
Elective: Technical electives (6)

Technical Electives

CE 197: Environmental Engineering II: Waste and Pollution Control (3)
EAd 150: Introduction to Engineering Administration (3)
EAd 160: Introduction to Engineering Economic Analysis (3)
EngS 215: Advanced Strength of Materials (3)
EngS 229: Transformations in Materials (3)
EngS 230: Deformation of Materials (3)
EngS 231: Structure of Materials (3)
EngS 237: Environmental Effects on Materials (3)
EngS 241: Failure of Materials (3)
*ME 176: Environmental Engineering Problems (3)
ME 192: Product Design and Process Engineering (3)
ME 215: Theory of Vibrations (3)
ME 221: Intermediate Fluid Mechanics (3)
ME 225: Turbomachinery I (3)
ME 237: Propulsion I (3)
ME 240: Kinematic Synthesis (3)
ME 247: Fluidics (3)

Technical Electives for Computer-oriented Mechanical Engineering Option

CSci 150: Introduction to Microcomputers (3)
CSci 153: Design of Switching Systems (3)
CSci 157: Machine and Assembly Language Programming (3)
CSci 278: Analog and Hybrid Computers (3)
EngS 282: Computer-aided Design (3)
EngS 283: Application of Computer Graphics in Engineering (3)
EngS 284: Numerical Methods in Engineering (3)
*ME 176: Environmental Engineering Problems (3)

*Required course which must be selected from the technical electives.

Technical Electives for Energy Resources and Power-oriented Mechanical Engineering Option

EE 177: Electrical Energy Conversion (3)
EngS 208: Energy Conservation (3)
EngS 214: Geothermal Energy (3)
*ME 176: Environmental Engineering Problems (3)
ME 224: Fundamentals of Combustion Engines (3)
ME 225: Turbomachinery I (3)
ME 237: Propulsion I (3)
ME 259: Solar Heating and Cooling of Buildings (3)
ME 260: Heating and Air Conditioning of Buildings (3)
ME 283: Nuclear Reactor Engineering I (3)
ME 294: Wind Energy (3)

Mechanical Engineering Undergraduate Courses

120 **Methods of Engineering Experimentation** (2)
Acquisition and analysis of experimental data. Laws of modeling and simulation. Report formulation and presentation. Basic principles of various measuring instruments and sensors. Laboratory experiments, including use of strain gages, oscilloscopes, various tranducers, etc. Introduction to basic experimental techniques related to dynamics, fluid flow, and thermal sciences. Prerequisite: CE 120, ME 131. (Spring)

126 **Fluid Mechanics** (3)
Fluid properties, regimes in fluid mechanics, fluid statics, fluid kinematics, basic equations, one- and two-dimensional inviscid incompressible flow, viscous incompressible flow, dimensional method. Prerequisite: ApSc 58. (Spring)

131 **Thermodynamics** (3)
Fundamental thermodynamic concepts, Zeroth law of thermodynamics and temperature measurements, work and heat, first law of thermodynamics, properties of pure substances, first-law analysis of some thermodynamic systems, second law of thermodynamics, reversibility, entropy, second-law analysis of thermodynamic systems. Prerequisite or concurrent registration: ApSc 58. (Fall)

134 **Introduction to Vibration Analysis** (3)
Natural frequencies and response of single- and multiple-degree of freedom mechanical systems to dynamic loads. Effect of damping, transient and steady-state analysis. Prerequisite: ApSc 58. (Fall)

148 **Thermodynamic Analysis** (3)
Second law analysis of thermodynamic systems. Mixtures of gases and vapors; properties of air–water vapor mixtures; psychrometry and its application in some engineering processes. Power from two-phase systems; Rankine cycle and engine, improving the thermal efficiency of Rankine engines; reheat and regeneration. Gas turbine; Brayton and regenerative cycles. Internal combustion engines; Otto and Diesel cycles. Thermodynamic analysis of reactive systems. Prerequisite: ME 131. (Spring)

152 **Mechanical Engineering Laboratory** (2)
Experimental study of various engineering systems. Laboratory projects include experimental design, modeling and simulation parameters, data acquisition, and report presentation techniques. Prerequisite: ME 120. (As arranged)

* Required course which must be selected from the technical electives.

155 Compressible Fluid Flow (3)
Introduction to compressible flow, basic equations, propagation of motion in compressible fluids, isotropic-flow relations, steady one-dimensional flow, wave phenomena, small perturbation theory, slender-body theory, method of characteristics. Prerequisite: ME 126, 131. (Fall)

176 Environmental Engineering Problems (3)
Atmospheric pollutants: Current levels and health problems. Combustion chemistry and mixing. Application to automobile and power plant controls. Photochemical processes. Smog and measurements. Atmospheric dispersion: Inversion and acid rain. Prerequisite: ME 131. (Fall)

187 Heat Transfer Theory (3)
Heat transfer processes. General heat conduction equations; steady- and unsteady-state heat conduction problems. Methods of analysis; analytical, analog, and numerical solution methods. Fundamentals of convective-heat transfer. Evaluation of convective-heat transfer coefficients; dimensional analysis, boundary-layer approach, analogy between heat and momentum transfer. Energy exchange by thermal radiation; fundamental concepts and laws, radiation properties, radiative-heat transfer between surfaces. Design considerations; heat-exchanger design and selection. Prerequisite: Senior status. (Fall)

190 Mechanisms, Analysis, and Synthesis (3)
Kinematics and dynamics of mechanisms. Displacement, velocities, accelerations in linkage and cam systems by analytical and graphical methods. Prerequisite: ApSc 58. (Fall)

191 Mechanical Design (3)
Introduction to design concept, selection of materials, and strength of mechanical elements; design of machine components such as shafts, springs, bearings, gears, couplings, screws, and related mechanical components. Prerequisite: senior status. (Fall)

192 Product Design and Process Engineering (3)
Introduction to product design and to modern manufacturing techniques. Functional, technological, and economic considerations, such as production volume, energy and materials consumption, and labor. Criteria for product acceptance, cost, and other factors. Properties and behavior of metals and polymers. Capabilities and limitations of various basic and secondary processes and their influence on product design. Prerequisite: senior status. (Spring)

193 Engineering Systems Design (3)
Creative engineering design, problem definition, and concept generation. Familiarization with standard machine components. Practice in integrating a variety of core disciplines via system design projects. Visual thinking, graphical communication, analysis and optimization techniques. Creative solutions to current, real engineering design problems. Design projects may integrate with ME 152 Mechanical Engineering Laboratory projects. Prerequisite: ME 191. (Spring)

194 Energy Conversion (3)
Energy sources and utilization, principal fuels for energy conversion. Production of thermal energy, conversion of chemical energy, fossil fuel systems. Energy conservation and environmental considerations in energy conversion and use. Production of electrical energy, fundamental principles, technological options, longer range possibilities. Energy management and economical considerations. Prerequisite: EE 20, ME 148. (Spring)

198 Research (1 to 3)
Applied research and experimentation projects, as arranged. Prerequisite: junior or senior status. (Fall and spring)

ENGINEERING SCIENCE—UNDERGRADUATE COURSE

4 Descriptive Geometry and Drafting (3)
Introductory descriptive geometry. Use of equipment. Points, lines, curves, planes, and surfaces; principal, auxiliary, and orthographic views; isometric views, intersection of surfaces. Technical sketching, dimensions and precision, machine elements. Detail and assembly drawings. Structural elements. Layout and fabrication drawings, pipe and electric prints. (Spring)

GRADUATE STUDY

Developments in science and technology in the decades to come require that the engineer be thoroughly grounded in fundamentals as well as in the newly emerging technological and scientific disciplines. The modern engineer must also master techniques in analysis, computation, design, and synthesis. Amidst the proliferation of knowledge and technological specialty, the Department adheres to the principle that versatility and depth in scientific fundamentals should be the characteristic features of any graduate program that attempts to prepare the student to cope with engineering developments.

The Department of Civil, Mechanical, and Environmental Engineering offers graduate programs in the various areas of concentration on three degree levels: the Master of Science degree, the Professional degree, and the Doctor of Science degree.

The Doctor of Science degree is offered in the following areas: acoustics; aeronautics; energy; environmental engineering; fluid mechanics and thermal sciences; ocean, coastal, and marine engineering; solid mechanics and materials engineering; structural engineering; structures and dynamics; transportation engineering (except Option III which is for the M.S. and Professional degrees only); and water resources (except Option II, water resources planning, which is for the M.S. degree only).

The Master of Science and the Professional degrees are offered in all of the aforementioned areas and in the following areas: computer-aided design, environmental modeling, geotechnical engineering, mechanical engineering design, and public works engineering.

Courses for these specializations are listed on subsequent pages. As part of the interdisciplinary program, students elect approved courses from other departments of the School of Engineering and Applied Science, as well as from other schools and divisions of the University. Depending upon the interest of the student, some of the programs leading to the degrees of Master of Science and, by special permission of the appropriate department chairman, Doctor of Science degrees are given at the NASA-Langley Research Center, Hampton, Va. NASA-Langley's extensive scientific and engineering facilities and equipment are utilized whenever feasible.

Each program is arranged to fit the student's individual needs and interests and utilize previous experience and background. This background should normally include an undergraduate degree in engineering, the physical sciences, or applied mathematics. Each student is assigned a faculty adviser on the basis of study interests, enabling a close student-faculty relationship to develop during the course of the program.

anguage Requirement for Doctoral Program

o foreign language is required for the Doctor of Science degree program. A roficiency in one computer programming language, however, must be demonrated to the doctoral adviser.

ields and Areas of Concentration

rograms of study in any field of concentration will generally include courses om appropriate allied areas.

OUSTICS*

ApSc 211: Analytical Methods in Engineering I
ApSc 212: Analytical Methods in Engineering II
ApSc 213: Analytical Methods in Engineering III
ApSc 215: Analytical Methods in Engineering V
ApSc 216: Special Topics in Engineering Analysis
EngS 203–4: Probability and Statistics of Metrology
EngS 217: Analytical Mechanics
EngS 270: Theoretical Acoustics I
*EngS 271: Random Process Theory I
*EngS 272: Random Process Theory II
*EngS 273: Time Series Analysis
EngS 274: Environmental Noise Control
*EngS 275: Theoretical Acoustics II
*EngS 276: Acoustical and Mechanical Measurements
*EngS 277: Physical Acoustics
*EngS 278: Psychological and Physiological Acoustics
*EngS 279: Human Factors in Engineering
*EngS 280: Special Topics in Acoustics
EngS 298: Research
S 299–300: Thesis Research
*EngS 310: Aeroacoustics
*EngS 311: Nonlinear Acoustics
*EngS 312: Theory of Random Vibration
*EngS 313: Structural Acoustics Interaction
EngS 398: Advanced Reading and Research
EngS 399: Dissertation Research
ME 215: Theory of Vibrations
ME 216: Structural Dynamics
ME 221: Intermediate Fluid Mechanics
ME 312: Theory of Turbulence

ONAUTICS*

ApSc 211: Analytical Methods in Engineering I
ApSc 212: Analytical Methods in Engineering II
ApSc 213: Analytical Methods in Engineering III
ApSc 214: Analytical Methods in Engineering IV
ApSc 215: Analytical Methods in Engineering V
ApSc 216: Special Topics in Engineering Analysis
EE 202: Linear System Theory I
EngS 217: Analytical Mechanics
EngS 284: Numerical Methods in Engineering
ME 215: Theory of Vibrations

* Offered at NASA-Langley Research Center; may be offered on campus when arranged.

ME 221: Intermediate Fluid Mechanics
ME 222: Applied Fluid Dynamics
ME 223: Aeroelasticity
ME 227: Viscous Flow
ME 231: Hydrodynamics
ME 235: Compressible Flow
ME 237: Energetics of Fluid Flow I
*ME 248: Seminar: Aircraft Design I
*ME 249: Seminar: Aircraft Design II
*ME 270: Applied Fluid Dynamics
*ME 271: VTOL Aircraft Technology
*ME 272: Powered-lift Technology
*ME 273: Principles of Automatic Flight Control
*ME 274: Principles of Flight Guidance
ME 275: Stability and Control of Vehicles
*ME 277: Numerical Methods in Fluid Mechanics
*ME 278: Performance, Stability, and Control of Helicopters
*ME 279: Special Topics in Flight Sciences
ME 281: Nonequilibrium Thermodynamics
*ME 290: Kinetic Theory of Gases
ME 295: Statistical Thermodynamics
ME 298: Research
ME 299–300: Thesis Research
ME 312: Theory of Turbulence
ME 315: Hypersonic Flow
ME 398: Advanced Reading and Research
ME 399: Dissertation Research

Required courses for MS Degree: ApSc 211, 213, ME 221, and 275.

COMPUTER-AIDED DESIGN

ApSc 213: Analytical Methods in Engineering III
CE 201: Design of Metal Structures
CE 202: Design of Reinforced Concrete Structures
CE 203: Prestressed Concrete Structures
CE 210: Methods of Structural Analysis
CE 250: Advanced Metal Structures
CE 251: Advanced Reinforced Concrete Structures
CE 252: General Structural Dynamics
CE 254: Special Topics in Structural Engineering
CE 261: Analysis of Plates and Shells
CE 262: Design of Plate and Shell Structures
CE 263: Theory of Structural Stability
CSci 158: Algorithmic Methods and High-level Languages
CSci 201: Introduction to Computer Systems
CSci 208: Computer Programming
CSci 213: Discrete Structures in Computing
CSci 214: Data Structures
CSci 219: Interactive Computer Graphics
CSci 227: Management Information Systems and Data Base Management
EngS 251–52: Transportation Workshop
EngS 282: Computer-aided Design
EngS 283: Application of Computer Graphics in Engineering
EngS 285: Finite Element Methods in Engineering Mechanics
EngS 288: Advanced Finite Element Methods in Structural Mechanics

* Offered at NASA-Langley Research Center; may be offered on campus when arranged.

ME 215: Theory of Vibrations
ME 216: Structural Dynamics
ME 218: Design of Floating and Submerged Marine Vehicles
ME 237: Energetics of Fluid Flow I
ME 238: Energetics of Fluid Flow II
ME 240: Kinematic Synthesis
ME 241: Engineering Systems Design
ME 242: Advanced Mechanisms
ME 243: Advanced Mechanical Engineering Design
ME 246: Electromechanical Control Systems
ME 247: Fluidics
ME 251: Advanced Electromechanical Control Systems

Required courses for MS Degree: ApSc 213, CSci 201, 213, 214, EngS 282, and CSci 219 or EngS 283.

ENERGY

ApSc 211: Analytical Methods in Engineering I
ApSc 212: Analytical Methods in Engineering II
ApSc 213: Analytical Methods in Engineering III
ApSc 215: Analytical Methods in Engineering V
CE 243: Environmental Impact Assessment
EAd 221–22: Environmental Management
EAd 283: Systems Engineering I
EngS 206: Technology and Human Needs
EngS 207: Engineering Climatology
EngS 208: Energy Conservation
EngS 210: Quantitative Aspects of Social Phenomena
EngS 212: Nonrenewable Resources
EngS 213: Renewable Resources
EngS 214: Geothermal Energy
EngS 242: Materials Recycling and Recovery
EngS 270: Theoretical Acoustics I
EngS 274: Environmental Noise Control
EngS 284: Numerical Methods in Engineering
ME 204: Advanced Instrumentation Techniques
ME 221: Intermediate Fluid Mechanics
ME 224: Fundamentals of Combustion Engines
ME 225: Turbomachinery I
ME 226: Turbomachinery II
ME 227: Viscous Flow
ME 235: Compressible Flow
ME 237: Energetics of Fluid Flow I
ME 254: Intermediate Heat and Mass Transfer
ME 257: Energy Technology I
ME 258: Energy Technology II
ME 259: Solar Heating and Cooling of Buildings
ME 260: Heating and Air Conditioning of Buildings
ME 261: Air Pollution I
ME 262: Air Pollution II
ME 263: Air Pollution Control Technology
ME 264: Air Pollution Seminar
ME 265: Air Pollution Meteorology
ME 280: Intermediate Thermodynamics
ME 281: Nonequilibrium Thermodynamics
ME 282: Fossil Fuels

ME 283:	Nuclear Reactor Engineering I
ME 284:	Nuclear Reactor Engineering II
ME 287:	Heat Conduction
ME 290:	Kinetic Theory of Gases
ME 291–92:	Power Systems
ME 293:	Combustion
ME 294:	Wind Energy
ME 298:	Research
ME 299–300:	Thesis Research
ME 312:	Theory of Turbulence
ME 313:	Magnetofluidmechanics
ME 398:	Advanced Reading and Research
ME 399:	Dissertation Research
OR 201:	Survey of Operations Research Methods

Required courses for Degree Programs in Energy Technology (Option 1): MS—ApSc 211, 213, ME 221, 254, 257, 258, 280; Professional Degree—EngS 284, ME 292, 298; DSc—ApSc 212, 215 and ME 281.

Required courses for Degree Programs in Energy Systems (Option 2): MS—ApSc 213, ME 257, 258, 261, and OR 201; Professional Degree—EngS 284 and ME 298.

ENVIRONMENTAL ENGINEERING

Option I: Water and Wastewater Engineering

ApSc 211:	Analytical Methods in Engineering I
ApSc 213:	Analytical Methods in Engineering III
ApSc 214:	Analytical Methods in Engineering IV
ApSc 215:	Analytical Methods in Engineering V
CE 211:	Physical Chemical Wastewater Treatment
CE 212:	Open Channel Flow
CE 213:	Hydraulic Structures
CE 216:	Advanced Hydrology
CE 219:	Groundwater and Seepage
CE 237:	Advanced Sanity Engineering Design
CE 240:	Environmental Microbiology
CE 241:	Environmental Chemistry
CE 242:	Solid Waste Disposal
CE 243:	Environmental Impact Assessment
CE 272:	Biological Wastewater Treatment
CE 273:	Water Supply Engineering
CE 276:	Water Resources Planning and Control
CE 277:	Industrial Waste Treatment
CE 278:	Pollutant Transport
CE 279:	Unit Operations in Environmental Engineering
CE 280:	Water Resources Systems
CE 298:	Research
CE 299–300:	Thesis Research
EngS 242:	Materials Recycling and Recovery
ME 221:	Intermediate Fluid Mechanics
ME 261:	Air Pollution I
ME 262:	Air Pollution II
ME 263:	Air Pollution Control Technology

Required courses for MS Degree: CE 211, 212, 240, 241, 272, 273.

Required courses for DSc Degree: ApSc 211, 213, CE 278, 279.

Option II: Air Pollution Engineering

ApSc 211:	Analytical Methods in Engineering I
or	
EngS 284:	Numerical Methods in Engineering
ApSc 213:	Analytical Methods in Engineering III
CE 211:	Physical Chemical Wastewater Treatment
CE 240:	Environmental Microbiology
CE 241:	Environmental Chemistry
CE 272:	Biological Wastewater Treatment
EAd 221–22:	Environmental Management
EngS 207:	Engineering Climatology
EngS 212:	Nonrenewable Resources
EngS 213:	Renewable Resources
EngS 270:	Theoretical Acoustics
EngS 274:	Environmental Noise Control
ME 204:	Advanced Instrumentation Techniques
ME 215:	Theory of Vibrations
ME 221:	Intermediate Fluid Mechanics
ME 224:	Fundamentals of Combustion Engineering
ME 227:	Viscous Flow
ME 231:	Hydrodynamics
ME 257–58:	Energy Technology
ME 261:	Air Pollution I
ME 262:	Air Pollution II
ME 263:	Air Pollution Control Technology
ME 264:	Air Pollution Seminar
ME 265:	Air Pollution Meteorology
ME 282:	Fossil Fuels
ME 288:	Convective Heat and Mass Transfer
ME 289:	Radiative Heat Transfer
ME 291–92:	Power Systems
ME 293:	Combustion
ME 312:	Theory of Turbulence

equired courses for MS Degree: ApSc 211 or EngS 284, ApSc 213, ME 221, 288, -263.

VIRONMENTAL MODELING *

ApSc 211:	Analytical Methods in Engineering I
ApSc 213:	Analytical Methods in Engineering III
*EngS 263:	Atmospheric Physics for Engineers I
*EngS 264:	Atmospheric Physics for Engineers II
EngS 284:	Numerical Methods in Engineering
EngS 298:	Research
gS 299–300:	Thesis Research
EngS 314:	Advanced Numerical Methods in Engineering
ME 221:	Intermediate Fluid Mechanics
ME 227:	Viscous Flow
ME 231:	Hydrodynamics
ME 257:	Energy Technology I
ME 265:	Air-pollution Meteorology
ME 285:	Reaction Kinetics
ME 288:	Convective Heat and Mass Transfer

ered at NASA-Langley Research Center; may be offered on campus when arranged.

ME 289: Radiative Heat Transfer
ME 296: Special Topics in Heat and Mass Transfer
ME 312: Theory of Turbulence

FLUID MECHANICS AND THERMAL SCIENCES

ApSc 211: Analytical Methods in Engineering I
ApSc 212: Analytical Methods in Engineering II
ApSc 213: Analytical Methods in Engineering III
ApSc 214: Analytical Methods in Engineering IV
ApSc 215: Analytical Methods in Engineering V
ApSc 216: Special Topics in Engineering Analysis
CE 274: Mechanics of Water Waves
EE 133: Electromagnetic Waves
EE 236: Plasma Dynamics
EngS 218: Introduction to Continuum Mechanics
EngS 284: Numerical Methods in Engineering
EngS 289: Special Topics in Theoretical and Applied Mechanics
EngS 315: Introduction to Nonlinear Mechanics of Continua
ME 218: Design of Floating and Submerged Marine Vehicles
ME 221: Intermediate Fluid Mechanics
ME 222: Applied Fluid Dynamics
ME 223: Aeroelasticity
ME 225: Turbomachinery I
ME 226: Turbomachinery II
ME 227: Viscous Flow
ME 231: Hydrodynamics
ME 235: Compressible Flow
ME 237: Energetics of Fluid Flow I
ME 238: Energetics of Fluid Flow II
ME 261: Air Pollution
ME 265: Air Pollution Meteorology
ME 277: Numerical Methods in Fluid Mechanics
ME 280: Intermediate Thermodynamics
ME 281: Nonequilibrium Thermodynamics
ME 282: Fossil Fuels
ME 287: Heat Conduction
ME 288: Convective Heat and Mass Transfer
ME 289: Radiative Heat Transfer
ME 293: Combustion
ME 295: Statistical Thermodynamics
ME 297: Special Topics in Fluid Mechanics
ME 298: Research
ME 299–300: Thesis Research
ME 310: Mechanics of Non-Newtonian Fluids
ME 311: Nonsteady Flow
ME 312: Theory of Turbulence
ME 313: Magnetofluidmechanics
ME 315: Hypersonic Flow
ME 317: Physical Gas Dynamics
ME 398: Advanced Reading and Research
ME 399: Dissertation Research

Required courses for MS Degree: ApSc 211, 213, ME 221, 280 (also ME 227 for non-thesis students); for Professional and DSc Degrees: Fluid Mechanics—ApSc 212 or 214 or 216, 215, ME 231, 288, 311, 312; Thermal Sciences—ApSc 212 or 214 or 216, 215, ME 235, 288, 287, 289.

OTECHNICAL ENGINEERING

ApSc 211: Analytical Methods in Engineering I
ApSc 213: Analytical Methods in Engineering III
CE 201: Design of Metal Structures
CE 202: Design of Reinforced Concrete Structures
CE 203: Prestressed Concrete Structures
CE 204: Applied Soil Mechanics I
CE 205: Applied Soil Mechanics II
CE 206: Foundation Engineering
CE 207: Soil Dynamics
CE 208: Rock Engineering
CE 209: Theoretical Soil Mechanics
CE 210: Methods of Structural Analysis
CE 212: Open Channel Flow
CE 213: Hydraulic Structures
CE 214: Design of Dams
CE 219: Groundwater and Seepage
CE 221: Pavement and Runway Design
CE 252: General Structural Dynamics
CE 253: Failure and Reliability Analysis of Engineering Structures
CE 254: Special Topics in Structural Engineering
CE 256: Introduction to Ocean and Coastal Engineering
CE 257: Harbor and Constal Engineering I
CE 265: Special Topics in Geotechnical Engineering
CE 282: Hydraulic Modeling
CE 298: Research
CE 299–300: Thesis Research
CE 310: Sedimentation Engineering
CE 311: Mechanics of Alluvial Channels
EngS 221: Theory of Elasticity I
EngS 222: Theory of Elasticity II
EngS 256: Introduction to the Theories of Inelastic Media
EngS 284: Numerical Methods in Engineering
EngS 285: Finite Element Methods in Engineering Mechanics
EngS 288: Advanced Finite Element Methods in Structural Mechanics
*Geol 128: Geomorphology
*Geol 189: Geophysics for Geologists
*Geol 224: Advanced Structural Geology

ired courses for MS Degree: ApSc 211 or 213, CE 204, 205, 206 and EngS 285.
Professional Degree: CE 207, 208, 219, and EngS 221.

CHANICAL ENGINEERING DESIGN

ApSc 213: Analytical Methods in Engineering III
CE 253: Failure and Reliability Analysis of Engineering Structures
EngS 215: Advanced Strength of Materials
S 251–52: Transportation Workshop
EngS 259: Random Vibrations of Structures
EngS 282: Computer-aided Design
EngS 283: Application of Computer Graphics in Engineering
ME 215: Theory of Vibrations
ME 218: Design of Floating and Submerged Marine Vehicles
ME 221: Intermediate Fluid Mechanics

course descriptions, see the *Undergraduate and Graduate Bulletin*.

ME 225:	Turbomachinery I
ME 226:	Turbomachinery II
ME 240:	Kinematic Synthesis
ME 241:	Engineering Systems Design
ME 242:	Advanced Mechanisms
ME 243:	Advanced Mechanical Engineering Design
ME 246:	Electromechanical Control Systems
ME 247:	Fluidics
ME 251:	Advanced Electromechanical Control Systems
ME 298:	Research
ME 299–300:	Thesis Research

Required courses for MS Degree: ApSc 213, ME 241, 243, 246.

OCEAN, COASTAL, AND MARINE ENGINEERING

ApSc 211:	Analytical Methods in Engineering I
ApSc 212:	Analytical Methods in Engineering II
ApSc 213:	Analytical Methods in Engineering III
ApSc 214:	Analytical Methods in Engineering IV
ApSc 215:	Analytical Methods in Engineering V
ApSc 216:	Special Topics in Engineering Analysis
CE 203:	Prestressed Concrete Structures
CE 206:	Foundation Engineering
CE 208:	Rock Engineering
CE 212:	Open Channel Flow
CE 213:	Hydraulic Structures
CE 214:	Design of Dams
CE 216:	Advanced Hydrology
CE 219:	Groundwater and Seepage
CE 253:	Failure and Reliability Analysis of Engineering Structures
CE 255:	Coastal Processes
CE 256:	Introduction to Ocean and Coastal Engineering
CE 257:	Harbor and Coastal Engineering I
CE 258:	Harbor and Coastal Engineering II
CE 265:	Special Topics in Geotechnical Engineering
CE 274:	Mechanics of Water Waves
CE 275:	Special Topics in Ocean Engineering
CE 282:	Hydraulic Modeling
CE 298:	Research
CE 299–300:	Thesis Research
CE 310:	Sedimentation Engineering
CE 311:	Mechanics of Alluvial Channels
CE 312:	Advanced Hydraulics
CE 398	Advanced Reading and Research
CE 399:	Dissertation Research
EngS 228:	Physical Oceanography
EngS 260:	Random Process Theory in Engineering
EngS 273:	Time Series Analysis
*Geol 181:	General Oceanography
ME 215:	Theory of Vibrations
ME 218:	Design of Floating and Submerged Marine Vehicles
ME 221:	Intermediate Fluid Mechanics
ME 227:	Viscous Flow
ME 231:	Hydrodynamics

* For course description, see the *Undergraduate and Graduate Bulletin*.

ME 277: Numerical Methods in Fluid Mechanics
ME 297: Special Topics in Fluid Mechanics
ME 312: Theory of Turbulence

quired courses for degree programs in Hydromechanics: MS—ApSc 211, 213, gS 260, and ME 221; DSc—ApSc 212, 214, 215, CE 274, ME 227, 312, 231.

quired courses for degree programs in Ocean, Coastal, and Marine Engineering: —ApSc 211, 213, EngS 260 and ME 221; DSc—ApSc 212, 215, CE 256, 274, 231, and ME 215 or EngS 273.

BLIC WORKS ENGINEERING

CE 201: Design of Metal Structures
CE 202: Design of Reinforced Concrete Structures
CE 203: Prestressed Concrete Structures
CE 204: Applied Soil Mechanics I
CE 205: Applied Soil Mechanics II
CE 206: Foundation Engineering
CE 208: Rock Engineering
CE 211: Physical and Chemical Wastewater Treatment
CE 212: Open Channel Flow
CE 213: Hydraulic Structures
CE 214: Design of Dams
CE 215: Urban Construction Technology
CE 216: Advanced Hydrology
CE 217: Water Resources Engineering
CE 220: Urban Transportation Engineering
CE 221: Pavement and Runway Design
CE 223: Traffic Engineering
CE 237: Advanced Sanitary Engineering Design
CE 242: Solid Waste Disposal
CE 243: Environmental Impact Assessment
CE 250: Advanced Metal Structures
CE 251: Advanced Reinforced Concrete Structures
CE 253: Failure and Reliability Analysis of Engineering Structures
CE 255: Coastal Processes
CE 256: Introduction to Ocean and Coastal Engineering
CE 257: Harbor and Coastal Engineering I
CE 258: Harbor and Coastal Engineering II
CE 276: Water Resources Planning and Control
CE 280: Water Resources Systems
CE 281: Special Topics in Water Resources
CE 282: Hydraulic Modeling
CE 310: Sedimentation Engineering
CE 311: Mechanics of Alluvial Channels
EAd 204: Administration of Engineering Contracts
EAd 210: Engineering Law
EAd 241: Construction Management I
EAd 242: Construction Management II
EAd 243: Construction Management III
EngS 284: Economic Analysis in Engineering Planning
OR 201: Numerical Methods in Engineering
Survey of Operations Research Methods

ed courses for MS Degree: CE 202, 206, 220, 243, 276, and EAd 241 or 242 or Professional Degree: CE 211 or 217 or 223, EngS 284 or OR 201, and one ional course from the sequence EAd 241, 242, 243.

SOLID MECHANICS AND MATERIALS ENGINEERING

ApSc 211:	Analytical Methods in Engineering I
ApSc 212:	Analytical Methods in Engineering II
ApSc 213:	Analytical Methods in Engineering III
ApSc 214:	Analytical Methods in Engineering IV
ApSc 215:	Analytical Methods in Engineering V
ApSc 216:	Special Topics in Engineering Analysis
CE 207:	Soil Dynamics
CE 209:	Theoretical Soil Mechanics
CE 252:	General Structural Dynamics
CE 253:	Failure and Reliability Ana'ysis of Engineering Structures
CE 254:	Special Topics in Structural Engineering
CE 261:	Analysis of Plates and Shells
CE 263:	Theory of Structural Stability
EngS 215:	Advanced Strength of Materials
EngS 217:	Analytical Mechanics
EngS 218:	Introduction to Continuum Mechanics
EngS 221:	Theory of Elasticity I
EngS 222:	Theory of Elasticity II
EngS 229:	Transformations in Materials
EngS 230:	Deformation of Materials
EngS 231:	Structure of Materials
EngS 233:	Mechanics of Composite Materials
EngS 234:	Composite Materials
EngS 236:	Experimental Techniques in Materials Science
EngS 237:	Environmental Effects on Materials I
EngS 240:	Fracture Mechanics
EngS 241:	Failure of Materials
EngS 242:	Materials Recycling and Recovery
EngS 249:	Special Topics in Materials Science
EngS 256:	Introduction to the Theories of Inelastic Media
EngS 259:	Random Vibration of Structures
EngS 284:	Numerical Methods in Engineering
EngS 285:	Finite Element Methods in Engineering Mechanics
EngS 288:	Advanced Finite Element Methods in Structural Mechanics
EngS 289:	Special Topics in Theoretical and Applied Mechanics
EngS 298:	Research
EngS 299–300:	Thesis Research
EngS 315:	Introduction to Nonlinear Mechanics of Continua
EngS 398:	Advanced Reading and Research
EngS 399:	Dissertation Research
ME 215:	Theory of Vibrations
ME 216:	Structural Dynamics
ME 221:	Intermediate Fluid Mechanics
ME 280:	Intermediate Thermodynamics
ME 281:	Nonequilibrium Thermodynamics
ME 295:	Statistical Thermodynamics
ME 310:	Mechanics of Non-Newtonian Fluids

Required courses for degree programs in Solid Mechanics: MS—ApSc 211, 213, EngS 218, 221; Professional Degree—EngS 222, 240, 241, 256, 285: DSc—ApSc 212, 215, EngS 222, 230, 256, 315.

Required courses for degree programs in Materials Engineering: MS—ApSc 211, 213, EngS 229, 231; Professional Degree—EngS 230, 234, 237, 240, 241; DSc—ApSc 212, EngS 229, 230, 231, 240, 256.

TRUCTURAL ENGINEERING

ApSc 212: Analytical Methods in Engineering II
ApSc 213: Analytical Methods in Engineering III
ApSc 214: Analytical Methods in Engineering IV
CE 201: Design of Metal Structures
CE 202: Design of Reinforced Concrete Structures
CE 203: Prestressed Concrete Structures
CE 204: Applied Soil Mechanics I
CE 205: Applied Soil Mechanics II
CE 206: Foundation Engineering
CE 207: Soil Dynamics
CE 210: Methods of Structural Analysis
CE 215: Urban Construction Technology
CE 250: Advanced Metal Structures
CE 251: Advanced Reinforced Concrete Structures
CE 252: General Structural Dynamics
CE 253: Failure and Reliability Analysis of Engineering Structures
CE 254: Special Topics in Structural Engineering
CE 256: Introduction to Ocean and Coastal Engineering
CE 257: Harbor and Coastal Engineering I
CE 258: Harbor and Coastal Engineering II
CE 261: Analysis of Plates and Shells
CE 262: Design of Plate and Shell Structures
CE 263: Theory of Structural Stability
CE 266: Design Procedures for Earthquake, Extreme Wind, and Other Natural Hazards I
CE 267: Design Procedures for Earthquake, Extreme Wind, and Other Natural Hazards II
CE 298: Research
CE 299–300: Thesis Research
CE 398: Advanced Reading and Research
CE 399: Dissertation Research
EngS 215: Advanced Strength of Materials
EngS 221: Theory of Elasticity I
EngS 233: Mechanics of Composite Materials
EngS 234: Composite Materials
EngS 240: Fracture Mechanics
EngS 241: Failure of Materials
EngS 256: Introduction to the Theories of Inelastic Media
EngS 259: Random Vibration of Structures
EngS 282: Computer-aided Design
EngS 283: Application of Computer Graphics in Engineering
EngS 284: Numerical Methods in Engineering
EngS 285: Finite Element Methods in Engineering Mechanics
EngS 288: Advanced Finite Element Methods in Structural Mechanics

ired courses for degree programs: MS—ApSc 213, CE 201 or 202, CE 210, 5 215 or 284, 285; Professional—CE 250 or 251, CE 252 or 253, CE 262, and 5 282 or 288; DSc—ApSc 212, 213 or 214, CE 252, CE 254 or EngS 259, EngS 268.

graduate-level course in Engineering Administration may be taken by students ed in this program.

TRUCTURES AND DYNAMICS

ApSc 211: Analytical Methods in Engineering I
ApSc 212: Analytical Methods in Engineering II

ApSc 213:	Analytical Methods in Engineering III
ApSc 214:	Analytical Methods in Engineering IV
ApSc 215:	Analytical Methods in Engineering V
ApSc 216:	Special Topics in Engineering Analysis
*CE 207:	Soil Dynamics
*CE 210:	Method of Structural Analysis
*CE 252:	General Structural Dynamics
CE 253:	Failure and Reliability Analysis of Engineering Structures
CE 254:	Special Topics in Structural Engineering
CE 261:	Analysis of Plates and Shells
CE 263:	Theory of Structural Stability
*CE 266:	Design Procedures for Earthquake, Extreme Wind, and Other Natural Hazard I
*CE 267:	Design Procedures for Earthquake, Extreme Wind, and Other Natural Hazard II
EE 157:	Machine and Assembly Language Programming
*EngS 215:	Advanced Strength of Materials
*EngS 217:	Analytical Mechanics
*EngS 218:	Introduction to Continuum Mechanics
EngS 221:	Theory of Elasticity I
EngS 222:	Theory of Elasticity II
*EngS 233:	Mechanics of Composite Materials
EngS 234:	Composite Materials
*EngS 240:	Fracture Mechanics
*EngS 256:	Introduction to the Theories of Inelastic Media
EngS 259:	Random Vibration of Structures
†EngS 281:	Advanced Programming Techniques for Engineering Mechanics Problems
EngS 282:	Computer-aided Design
EngS 283:	Application of Computer Graphics in Engineering
EngS 284:	Numerical Methods in Engineering
EngS 285:	Finite Element Methods in Engineering Mechanics
†EngS 286:	Analysis and Design of Thin-walled Structures
†EngS 287:	Automated Design of Complex Structures
EngS 288:	Advanced Finite Element Methods in Structural Mechanics
EngS 289:	Special Topics in Theoretical and Applied Mechanics
EngS 299–300:	Thesis Research
EngS 314:	Advanced Numerical Methods in Engineering
*EngS 315:	Introduction to Nonlinear Mechanics of Continua
EngS 398:	Advanced Reading and Research
EngS 399:	Dissertation Research
ME 215:	Theory of Vibrations
ME 216:	Structural Dynamics
†ME 223:	Aeroelasticity
†ME 248:	Seminar: Aircraft Design I
OR 251:	Linear Programming
OR 252:	Nonlinear Programming

Required courses for degree programs *on campus:* MS—ApSc 213, CE 253, 261, 263, EngS 215, and ME 215 or CE 252; DSc—ApSc 212, 214 or 215, ME 216, EngS 221, and 259.

Required courses for degree program at NASA-Langley Research Center: MS—ApSc 213, CE 261 or 263, EngS 221 or 234, 284, 285, 286 or 287; DSc—ApSc 214, EngS 288, ME 215 or 223, EngS 281.

*Course offered on campus only.

†Course offered at NASA-Langley Research Center only.

TRANSPORTATION ENGINEERING

Option I: Technology of the Vehicle

ApSc 213: Analytical Methods in Engineering III
ApSc 214: Analytical Methods in Engineering IV
ApSc 215: Analytical Methods in Engineering V
CE 201: Design of Metal Structures
CE 210: Methods of Structural Analysis
CE 220: Urban Transportation Engineering
CE 252: General Structural Dynamics
CE 253: Failure and Reliability Analysis of Engineering Structures
CE 261: Analysis of Plates and Shells
CE 263: Theory of Structural Stability
EngS 215: Advanced Strength of Materials
EngS 221: Theory of Elasticity I
EngS 241: Failure of Materials
EngS 251–52: Transportation Workshop
EngS 253: Control of Automated Transit Networks
EngS 259: Random Vibration of Structures
EngS 260: Random Process Theory in Engineering
EngS 285: Finite Element Methods in Engineering Mechanics
EngS 288: Advanced Finite Element Methods in Structural Mechanics
EngS 315: Introduction to Nonlinear Mechanics of Continua
ME 215: Theory of Vibrations
ME 218: Design of Floating and Submerged Marine Vehicles
ME 221: Intermediate Fluid Mechanics
ME 222: Applied Fluid Dynamics
ME 223: Aeroelasticity
ME 225: Turbomachinery I
ME 226: Turbomachinery II
ME 227: Viscous Flow
ME 231: Hydrodynamics
ME 237: Energetics of Fluid Flow I
ME 238: Energetics of Fluid Flow II
ME 241: Engineering Systems Design
ME 243: Advanced Mechanical Engineering Design
ME 246: Electromechanical Control Systems
ME 250: Design of Complex Systems
ME 251: Advanced Electromechanical Control Systems
ME 255–56: Urban Transportation Technology
ME 275: Stability and Control of Vehicles
ME 286: Special Topics in Mechanical Engineering
ME 293: Combustion
ME 298: Research
ME 299–300: Thesis Research
ME 311: Nonsteady Flow
ME 398: Advanced Reading and Research
ME 399: Dissertation Research
UP&RP 208: Urban Transportation Planning
UP&RP 209: Urban Transportation Models

Required courses for MS Degree: (Mechanical)—CE 220, EngS 251, ME 221, 237; (Structural)—CE 210, 220, 252 and EngS 251.

DSc Degree: (Mechanical)—ApSc 213, 215, ME 293 and ME 238 or 311; (Structural)—ApSc 213 or 214, CE 252, EngS 285, 288, 221 or 315.

For course descriptions, see the *Undergraduate and Graduate Bulletin.*

Option II: The Way (Route Structures and Facilities)

ApSc 212:	Analytical Methods in Engineering II
ApSc 213:	Analytical Methods in Engineering III
ApSc 214:	Analytical Methods in Engineering IV
CE 201:	Design of Metal Structures
CE 202:	Design of Reinforced Concrete Structures
CE 203:	Prestressed Concrete Structures
CE 204:	Applied Soil Mechanics I
CE 205:	Applied Soil Mechanics II
CE 206:	Foundation Engineering
CE 207:	Soil Dynamics
CE 209:	Theoretical Soil Mechanics
CE 210:	Methods of Structural Analysis
CE 220:	Urban Transportation Engineering
CE 221:	Pavement and Runway Design
CE 222:	Stations and Terminals
CE 223:	Traffic Engineering
CE 252:	General Structural Dynamics
CE 253:	Failure and Reliability Analysis of Engineering Structures
CE 256:	Introduction to Ocean and Coastal Engineering
CE 257:	Harbor and Coastal Engineering I
CE 258:	Harbor and Coastal Engineering II
CE 310:	Sedimentation Engineering
CE 311:	Mechanics of Alluvial Channels
EngS 215:	Advanced Strength of Materials
EngS 221:	Theory of Elasticity I
EngS 240:	Fracture Mechanics
EngS 241:	Failure of Materials
EngS 251–52:	Transportation Workshop
EngS 253:	Control of Automated Transit Networks
EngS 259:	Random Vibration of Structures
EngS 285:	Finite Element Methods in Engineering Mechanics
EngS 288:	Advanced Finite Element Methods in Structural Mechanics
EngS 298:	Research
EngS 299–300:	Thesis Research
EngS 315:	Introduction to Nonlinear Mechanics of Continua
EngS 398:	Advanced Reading and Research
EngS 399:	Dissertation Research
ME 255–56:	Urban Transportation Technology
OR 231:	Theory of Traffic Flow
*U&RP 208:	Urban Transportation Planning
*U&RP 209:	Urban Transportation Models

Required courses for degree programs: MS—CE 201 or 202, 210, 220, 221 or 223, and EngS 251; DSc—ApSc 212, 213 or 214, CE 252, EngS 285, 288, and EngS 221 or 315.

Option III: Transportation Systems†

CE 220:	Urban Transportation Engineering
CE 223:	Traffic Engineering
CE 243:	Environmental Impact Assessment
EAd 261:	Economic Analysis in Engineering Planning

*For course descriptions, see the *Undergraduate and Graduate Bulletin*.
†Prerequisite courses for admission to this option are ApSc 115 and Stat 191 (see the *Undergraduate and Graduate Bulletin*).

EAd 265: Transportation Management I
EAd 266: Transportation Management II
EAd 281-82: Systems Analysis and Management
EngS 251-52: Transportation Workshop
EngS 253: Control of Automated Transit Networks
ME 255-56: Urban Transportation Technology
ME 298: Research
ME 299-300: Thesis Research
OR 201: Survey of Operations Research Methods I
OR 202: Survey of Operations Research Methods II
OR 231: Theory of Traffic Flow
OR 251: Linear Programming
OR 252: Nonlinear Programming
OR 271: Forecasting Techniques
OR 273: Digital Systems Simulation
OR 277: Queuing Theory
'U&RP 201: Introduction to Urban and Regional Planning
'U&RP 208: Urban Transportation Planning
'U&RP 209: Urban Transportation Models

quired courses for MS degree: CE 220, 223, EngS 251, and OR 201.

TER RESOURCES ENGINEERING

Option I: Water Resources Engineering

ApSc 211: Analytical Methods in Engineering I
ApSc 213: Analytical Methods in Engineering III
ApSc 214: Analytical Methods in Engineering IV
ApSc 215: Analytical Methods in Engineering V
CE 208: Rock Engineering
CE 212: Open Channel Flow
CE 213: Hydraulic Structures
CE 214: Design of Dams
CE 216: Advanced Hydrology
CE 219: Groundwater and Seepage
CE 243: Environmental Impact Assessment
CE 255: Coastal Processes
CE 256: Introduction to Ocean and Coastal Engineering
CE 273: Water Supply Engineering
CE 274: Mechanics of Water Waves
CE 276: Water Resources Planning and Control
CE 278: Pollution Transport System
CE 279: Unit Operations in Environmental Engineering
CE 281: Special Topics in Water Resources
CE 282: Hydraulic Modeling
CE 298: Research
E 299-300: Thesis Research
CE 310: Sedimentation Engineering
CE 311: Mechanics of Alluvial Channels
CE 312: Advanced Hydraulics
CE 398: Advanced Reading and Research
CE 399: Dissertation Research
EngS 260: Random Process Theory in Engineering
EngS 284: Numerical Methods in Engineering

rse descriptions, see the *Undergraduate and Graduate Bulletin.*

EngS 285:	Finite Element Methods in Engineering Mechanics
ME 221:	Intermediate Fluid Mechanics
ME 227:	Viscous Flow
ME 231:	Hydrodynamics
ME 277:	Numerical Methods in Fluid Mechanics
ME 312:	Theory of Turbulence
OR 251:	Linear Programming
OR 252:	Nonlinear Programming
OR 273:	Digital Systems Stimulation

Required courses for degree programs: MS—ApSc 211 and/or 213 (depending o adviser's approval), CE 212, 213, 282 or 312 (depending on adviser's approval); Pr fessional and DSc—ApSc 211, 213, CE 282, 312, ME 221.

Option II: Water Resources Planning

ApSc 213:	Analytical Methods in Engineering III
CE 212:	Open Channel Flow
CE 213:	Hydraulic Structures
CE 214:	Design of Dams
CE 216:	Advanced Hydrology
CE 242:	Solid Waste Disposal
CE 243:	Environmental Impact Assessment
CE 273:	Water Supply Engineering
CE 276:	Water Resources Planning and Control
CE 278:	Pollution Transport System
CE 279:	Unit Operations in Environmental Engineering
CE 280:	Water Resources Systems
CE 281:	Special Topics in Water Resources
CE 282:	Hydraulic Modeling
CE 298:	Research
CE 299–300:	Thesis Research
CE 310:	Sedimentation Engineering
CE 311:	Mechanics of Alluvial Channels
EAd 211–12:	Engineering Administration
EAd 269:	Elements of Decision-making and Problem-solving
EAd 283:	Systems Engineering I
EAd 284:	Systems Engineering II
EngS 206:	Technology and Human Needs
EngS 213:	Renewable Resources
EngS 260:	Random Process Theory in Engineering
EngS 284:	Numerical Methods in Engineering
ME 221:	Intermediate Fluid Mechanics
OR 251:	Linear Programming
OR 252:	Nonlinear Programming
OR 253:	Integer, Network, and Dynamic Programming
OR 271:	Forecasting Techniques
OR 273:	Digital Systems Simulation
OR 377:	Advanced Stochastic Models in Operations Research
*Econ 217–18:	Survey of Economics
*Econ 235:	Energy Resources and Policy
*Econ 237:	Seminar: Economics of the Environment and Natural Resources
*Geog 222:	Seminar: Resources and the Environment
*Geog 223:	Seminar: The Population-Food Balance
*PSc 206:	Science, Technology, and Public Affairs

Required courses for MS degree: CE 212, 213, 276, 280.

* For course descriptions, see the *Undergraduate and Graduate Bulletin*.

Civil Engineering Graduate Courses

201 Design of Metal Structures (3)
Structural behavior of metal structures, conception and design of advanced structural components and systems, hysteretic behavior, plastic design principles, box type girders, cable systems, composite girders, and special topics. Prerequisite: CE 191 or equivalent. (Spring)

202 Design of Reinforced Concrete Structures (3)
Structural behavior of reinforced concrete structures, conception and design of structural components, prestressed concrete, slabs, ultimate strength and deformation, box type girders, hysteretic behavior, safety considerations, and special topics. Prerequisite: CE 192 or equivalent. (Fall)

203 Prestressed Concrete Structures (3)
Structural behavior and failure modes of prestressed concrete structures; design in prestressed concrete, including long-span structures, bridges, and precast systems. Prerequisite: CE 192 or equivalent. (Spring)

204 Applied Soil Mechanics I (3)
Theories of soil strength; bearing capacity of shallow foundations and their design; deep foundations, including pile types and design criteria; theories of lateral earth pressure with applications; stability analyses of slopes. Selected experiments in the soil mechanics laboratory. Prerequisite: approval of Department. (Spring)

205 Applied Soil Mechanics II (3)
Nature of soil, including geological and pedological aspects; flow of water in soil; seepage involving foundations, dams, and wells; stress distribution in earth masses; one- and three-dimensional theories of consolidation; analysis of settlement. Selected experiments in the soil mechanics laboratory. Prerequisite: approval of Department. (Fall)

206 Foundation Engineering (3)
Principles of soil mechanics and structural mechanics applied to the analysis and design of spread footings and mat foundations, pile foundations, retaining structures, including sheeting and bracing systems, and waterfront structures. Problems associated with subsurface exploration, dewatering excavations, and underpinning. Prerequisite: approval of Department. (Spring)

207 Soil Dynamics (3)
Stress-strain behavior of soil under transient and repeated loads, effects of earthquakes upon foundations and earth dams, design of machinery foundations. Prerequisite: CE 204. (As arranged)

208 Rock Engineering (3)
Classification and properties of rock; nature of rock masses and rock discontinuities; field exploration; methods of excavation; design and applications to foundation slopes, tunnels, and chambers in rock. Prerequisite: approval of Department. (As arranged)

209 Theoretical Soil Mechanics (3)
Advanced theories of consolidation. Yield condition in soils. Application of theories of plasticity in soil mechanics. Elements of wave propagation in soils, including surface waves. Prerequisite: ApSc 213, and CE 204 or 205. (As arranged)

210 Methods of Structural Analysis (3)
Modern methods of analysis of statically indeterminate structures, matrix analysis based on flexibility, stiffness, energy and variational methods, substructuring techniques; consideration of plastic collapse of structures; introduction to the finite element method. Prerequisite: graduate status. (Fall)

211 Physical and Chemical Wastewater Treatment (3)
Theory and application of physical and chemical operation and processes for wastewater treatment. Topics of discussion will include sedimentation; flotation; disinfection; coagulation; flocculation; filtration; carbon adsorption; reverse osmosis; ion exchange and thickening. Prerequisite: CE 197 or equivalent; prerequisite or concurrent registration: CE 241. (Fall)

212 Open Channel Flow (3)
Types and regimes of flow; energy and momentum principles, uniform flow, gradually varied flow, spatially and rapidly varied flow. Flow in non-prismatic channels. Unsteady flow; dam break problem, flood routing. Prerequisite: CE 193 or ME 221. (Fall)

213 Hydraulic Structures (3)
Forces on structures and hydraulic design criteria. Design of conveyance, diversion, cross drainage, protective and water measurement structures. Prerequisite: CE 212 or approval of Department. (Spring)

214 Design of Dams (3)
Project planning and investigations. Types of dams; design of earth-rock fill dams and concrete gravity dams. Design of outlets, spillways, and appurtenances. Construction methods for dams. Reservoir sedimentation. Safety inspection of dams. Prerequisite: CE 193 or graduate status. (Spring, even years)

215 Urban Construction Technology (3)
Precedents and contemporary trends in urban housing, building, and planning technology. Prerequisite: approval of Department. (Spring)

216 Advanced Hydrology (3)
Precipitation, evaporation, and transpiration. Soil physics; stream flow, drainage basins, hydrograph analysis, and stream-flow routing. Design criteria, flood frequency statistics and analysis, flood forecasting and control, water supply forecasting. Prerequisite: CE 195 or equivalent. (Spring, even years)

219 Groundwater and Seepage (3)
Permeability theory of groundwater flow, flownets, analogs, computer solutions; applications to engineering problems such as excavation dewatering, flow through dams, stabilization of earth slopes. Prerequisite: ApSc 211. (Fall)

220 Urban Transportation Engineering (3)
Introduction to urban transportation planning. Analysis of urban transportation requirements. Evaluation procedure for the selection between alternative solutions. Prerequisite: approval of Department. (Fall and spring)

221 Pavement and Runway Design (3)
Pavement types, wheel-load characteristics; stresses in pavements and subgrades; empirical methods of design of flexible and rigid highway and airfield pavements; general principles of runway design. Prerequisite: CE 202, and 204 or 205. (Spring)

222 Stations and Terminals (3)
Unified treatment of the functions and operation of stations and terminals of transportation systems; emphasis on specifications and planning criteria. Problems of locating the facility, passenger and freight handling, intra-modal and inter-modal interfacing, communication and control. Illustrations include railroad and subway stations, bus terminals, airports, and harbors. Prerequisite: approval of Department. (Spring)

223 Traffic Engineering (3)
Roadway traffic capacity and other road network performance measures; methods of characterizing steady and unsteady traffic flow phenomena; traffic behavior monitoring techniques, instruments, and data processing; impact of vehicle and operator dynamics on traffic flow behavior; road bottleneck flow dynamics; traffic control signalization theory and practical implementation; traffic signal control systems for conventional street networks and limited access expressways; examples of traffic control system implementations. Prerequisite: approval of Department. (Fall)

237 Advanced Sanitary Engineering Design (3)
Basic principles and practical considerations; hydraulic and structural requirements; basic parameters and elements of design; layout and design of water supply and sewage systems, pumping stations, and wastewater treatment plants; development of design parameters; cost and financing; existing plant expansions. Prerequisite or concurrent registration: CE 211 and 272. (Fall)

240 Environmental Microbiology (3)
Basic cellular organizations and processes related to waste treatment; microorganisms as disease-carrying agents in natural and waste water; laboratory tests for coliform organisms and viruses, and analysis of activated sludge. Prerequisite: approval of Department. (Spring)

241 Environmental Chemistry (3)
Chemical composition and chemical analysis of water; chemical treatment of water and waste water; laboratory tests of solids, BOD, COD, phosphorus, nitrogen, etc., as related to water quality. Prerequisite: approval of Department. (Fall)

242 Solid Waste Disposal (3)
Characteristics of solid waste; collection, transportation, and disposal practices; regional planning and management; resource and energy recovery from solid waste. Prerequisite: approval of Department. (Fall, even years)

243 Environmental Impact Assessment (3)
Public policy and legislation at federal, state, and local levels concerning quality of the environment. Strategies and methodologies which have been developed to assess impact of engineering projects. Technology of assessing impact on air and water quality and on land use, applied to transportation facilities, water supply and pollution control facilities, and industrial and community development. Prerequisite: approval of Department. (Fall)

250 Advanced Metal Structures (3)
Conception, analysis, and design of low-rise and high-rise buildings by elastic and inelastic methods, suspended roofs, earthquake considerations, and unique structural systems. Prerequisite: CE 201 or equivalent. (Fall)

251 Advanced Reinforced Concrete Structures (3)
Conception, analysis, and design of low-rise and high-rise buildings by ultimate strength methods, precast systems, progressive collapse, earthquake considerations, domes, folded plates, shell-type structures and special topics. Prerequisite: CE 202 or equivalent. (Spring)

252 General Structural Dynamics (3)
Analysis of single and multiple degree of freedom structural system under steady-state and transient loads; response of discretized structural systems, such as rigid frames, plates, and thin shells under dynamic loads. Prerequisite: CE 210, or equivalent and approval of Department. (Spring)

253 Failure and Reliability Analysis of Engineering Structures (3)
Operational and structural failure mechanisms; fracture and fatigue. Operational and structural safety, probability of failure. Aspects of probabilistic structural analysis, statistics of extremes, risk and reliability, optimal design criteria. Reliability of structural systems in design service life; perturbation, Monte Carlo simulation, and proof test methods; inspection and repair maintenance. Prerequisite: ApSc 115 or equivalent. (Fall)

254 Special Topics in Structural Engineering (3)
Selected problems in structural mechanics and design: (1) thermal stresses in structural systems, (2) advanced probabilistic structural mechanics, (3) structural design for dynamic loads, (4) structural design for repeated loads, or (5) advanced structural applications. May be repeated for credit. Prerequisite: CE 210 and approval of Department. Topic to be announced in the *Schedule of Classes*. (As arranged)

255 Coastal Processes (3)
Longshore currents and nearshore circulation; coastal sediment properties and analysis, longshore transport processes and rates; sediment budget; response of beaches to wave action and structures; tidal inlets, mechanical bypassing; beach nourishment; wind transport of sandy dune stabilization, sediment tracing. Prerequisite: approval of Department. (Spring)

256 Introduction to Ocean and Coastal Engineering (3)
Application of wave mechanics to the analysis of wave motion in coastal and offshore regions: reflection, diffraction, refraction. Wave spectra: procurement of spectral data by direct measurement or from hind-casting techniques. Beaches and littoral drift, mixing processes, outfalls and intakes in the oceans and estuaries, wave forces on coastal and offshore structures, harbor oscillations, tides in estuaries. Prerequisite: ApSc 115, ME 221; or equivalent. (Fall)

257 Harbor and Coastal Engineering I (3)
Waves and swells, tides and currents, coastal regime, estuaries and deltas, structures for coastal protection, principles of harbor navigation, harbor planning and harbor design, breakwaters and sea walls, quays, docks, internal access structures; maintenance of external and internal access, dredging. Prerequisite: CE 256. (Spring)

258 Harbor and Coastal Engineering II (3)
Interaction between structures and waves. Analysis and design of flexible structures: piers, jetties, and protective structures; off-shore drilling platforms. Design criteria, moorings and cables, harbor operations equipment. Prerequisite: CE 252 or equivalent; CE 257. (Fall)

261 Analysis of Plates and Shells (3)
Bending and stretching of thin elastic plates under loading with various boundary conditions, continuous plates and plates on elastic foundations, theory of folded plate structures. Theory of curved surfaces; general linear bending theory and its simplification to membrane theory; bending stresses in shells of revolution, shallow shell theory. Specific applications. Prerequisite: graduate status. (Spring)

262 Design of Plate and Shell Structures (3)
Design of long-span plate and shell roof structures in reinforced concrete and metal; design of containers for fluids and granular materials; computer applications in the analysis of such structures. Prerequisite: CE 201, 202, 261; or equivalent. (Fall)

263 Theory of Structural Stability (3)
General criteria for stability; buckling of elastic and inelastic columns and frames; torsional and lateral buckling; variational methods. Buckling of

plates and shells under static loads; stability of stiffened structures; effect of imperfections and boundary conditions. Prerequisite: graduate status. (Fall)

265 **Special Topics in Geotechnical Engineering** (3)
Selected topics such as rheology of soils, computer applications, excavation and tunneling, ocean engineering problems, or other special topics. May be repeated for credit. Prerequisite: approval of Department. (As arranged)

266 **Design Procedures for Earthquake, Extreme Wind, and Other Natural Hazards I** (3)
Nature of dynamic loads in problems which arise from earthquakes, tornadoes, hurricanes, and recurring winds; other natural hazard loading such as floods, expansive soils, storm surges, and tsunamis; characteristics of earthquakes; seismicity, zoning maps, response spectra, wind characterization, and wind tunnel simulation. Use of probabilistic concepts in load determination. Prerequisite: approval of Department. (Spring)

267 **Design Procedures for Earthquake, Extreme Wind, and Other Natural Hazards II** (3)
Brief review of natural hazard loadings and random formulation; earthquake and wind design considerations and procedures; review of code requirements and specifications; balanced risk approach for natural hazards; cost effectiveness of integrated natural hazard design; special problems. Prerequisite: CE 266 or approval of Department. (Fall)

271 **Theoretical Marine Hydromechanics** (3)
Introductory course designed to acquaint the student with some physical concepts and mathematical tools of theoretical marine hydromechanics. Derivation of the fundamental equations and boundary conditions of a fluid media; application of potential-flow theory to fluid motion around two- and three-dimensional bodies; perturbation concepts. Introduction to thin-ship and slender-body theories. Derivation of force and movement of bodies in calm and disturbed water. Prerequisite: approval of Department. Offered off-campus only. (As arranged)

272 **Biological Wastewater Treatment** (3)
Theory and application of biological methods for wastewater treatment. Principles of biological treatment; biological lagoons; trickling filter activated sludge process; anaerobic and aerobic digestion of sludge. Prerequisite or concurrent registration: CE 240. (Spring)

273 **Water Supply Engineering** (3)
Quantity and quality aspects of water supply engineering are discussed. Topics include reservoir sizing, groundwater, distribution systems, treatment processes and chemistry of waters. Prerequisite or concurrent registration: CE 240 and 241. (Spring)

274 **Mechanics of Water Waves** (3)
Irrotational theory for deep- and shallow-water waves, reflexion, refraction, diffraction, attenuation. Water waves of finite amplitude: shallow-water theory, tides, bores, long-waves theory, conoidal and solitary waves. Wave generation by wind, state-of-the-art based on correlation between theory and measurements. Wave-breaking and reflexion. Prerequisite: ME 221 or equivalent and permission of instructor. (Fall)

275 **Special Topics in Ocean Engineering** (3)
Selected topics: (1) marine aspects of viscous-flow theory, (2) interfacial (internal) waves, (3) applied random processes in ocean and coastal engineering, or (4) other selected topics. May be repeated for credit. Prerequisite: approval of Department. (Spring)

276 Water Resources Planning and Control (3)
The parameters of water resources planning and control; economics of water resources and related natural resources; economics of water quality control; physical parameters of water resource development; water resources law. Prerequisite: approval of Department. (Fall)

277 Industrial Waste Treatment (3)
The nature of industry and waste generation; industrial waste characteristics; waste measurements; techniques utilized in industrial waste treatment and control; nuclear waste control; reuse of industrial effluents and sewage for industrial process water; problems associated with treatment and disposal of industrial wastes and their effects on receiving waters. Prerequisite: CE 211 or equivalent; prerequisite or concurrent registration: CE 240. (Fall, odd years)

278 Pollution Transport System (3)
Distribution of pollutants in natural waters and atmosphere; diffusive and advective transport; mathematics for stream pollutant deoxygeneration rates; groundwater pollution transport; sediment transport; thermal transport; numerical simulation of pollutant transports in streams and estuaries. Prerequisite: CE 193, ME 131. (Fall, odd years)

279 Unit Operations in Environmental Engineering (3)
Lecture and laboratory. Investigation of unit processes used in water and wastewater treatment. Current literature is reviewed and experiments carried out. Prerequisites or concurrent registration: CE 211, 272. (Spring, even years)

280 Water Resources Systems (3)
Water resources planning and control; water quality planning, water supply planning, comprehensive planning and management. Case studies of systems. Prerequisite: CE 276. (Spring)

281 Special Topics in Water Resources (3)
Selected Topics: morphometric properties of drainage basins; drainage network analysis; hydraulic geometry of streams; advanced hydraulics of alluvial channels; modeling of drainage basins; computer applications; stochastic hydrology. Prerequisite: approval of Department. (As arranged)

282 Hydraulic Modeling (3)
Dimensional analysis and similitude. Types of models; physical models; mathematical models. Distortions in physical models. Erodible bed models. Prerequisite: CE 193 or ME 221 or graduate status. (Spring, odd years)

298 Research (arr.)
Basic research projects, as arranged. May be repeated for credit. (Fall and spring)

299–300 Thesis Research (3–3)
(Fall and spring)

310 Sedimentation Engineering (3)
Problems of erosion and sedimentation. Properties of sediment. Initiation of motion. Suspension of sediment and sediment discharge theories. Sedimentation measurements. Economic and legal aspects. Prerequisite: CE 212 or approval of Department. (Fall)

311 Mechanics of Alluvial Channels (3)
Physical processes in drainage basins and channels. Channel forms and bed forms. Hydraulics and sediment transport in alluvial channels. Design of stable channels. Qualitative and quantitative response of rivers. Channel stabilization, navigation channels. Case studies including environmental impacts. Prerequisite: CE 212 or approval of Department. (Spring)

312 Advanced Hydraulics (3)
Continuity, energy, and momentum equations. Turbulence, diffusion, and dispersion. Cavitation, waves, subsurface flow. Special problems in flow through hydraulic and marine structures. (Spring, even years)

398 Advanced Reading and Research (arr.)
Limited to students preparing for the Doctor of Science qualifying examination. May be repeated for credit. (Fall and spring)

399 Dissertation Research (arr.)
Limited to Doctor of Science candidates. May be repeated for credit. (Fall and spring)

hanical Engineering Graduate Courses

204 Advanced Instrumentation Techniques (3)
Pressure and temperature sensors; shadowgraph, schlieren and interferometer systems; laser holography; laser doppler velocimetry; signal conditioning, use of amplifiers with shielding and grounding techniques; digital techniques; signal multiplexing; use of computers; error analysis and data handling. Lecture and laboratory. Prerequisite: approval of Department. (Fall)

215 Theory of Vibrations (3)
Damped and undamped natural vibrations, transient response and response to harmonic and periodic excitation, natural vibration of discrete and continuous systems; integral formulation of eigenvalue problems, response by modal analysis, approximate methods, influence of secondary effects and constraints, damped systems. Prerequisite: approval of Department. (Fall)

216 Structural Dynamics (3)
Methods of solving vibration problems: differential equation, Rayleigh-Ritz finite element. Free and forced vibration of structural components: straight, curved, and thin-walled beams; plates and shells; sandwich construction. Vibration of built-up structures. Structural wave motion, wave motion in periodic structures. Prerequisite: ME 215. (As arranged)

218 Design of Floating and Submerged Marine Vehicles (3)
Consideration of interaction between hydrodynamics, propulsion, and configuration aspects of design of floating structures and vehicles; effects of submergence and deep submergence; hydrofoil and vertical jet action; structural considerations. Prerequisite: EngS 228. (Fall)

221 Intermediate Fluid Mechanics (3)
The continuum, kinematics of fluids; stress tensor, strain and rate-of-strain tensor; fundamental equations of the flow of viscous compressible fluids; Laplace's equations; source, sink, and doublet; vortices, Biot-Savart theorem and the flow field of a vortex; spherical and cylindrical harmonics; methods of singularity distributions, complex-variable methods; laminar flow of viscous incompressible fluids; boundary-layer concept. Prerequisite: approval of Department. (Fall)

222 Applied Fluid Dynamics (3)
Subsonic lifting line wing theory, direct and inverse solution of the lifting surface theory; singularity method for wing-body combination; vortex lift theory; effects of camber and twist distribution; transonic airfoils, effect of wing sweep, area ruling concept; supersonic linearized wing theory; similarity rules. Prerequisite: ME 221 or equivalent. (Spring)

223 Aeroelasticity (3)
Introduction to aeroelastic phenomena; structural deformations of vehicles under static and dynamic loads; vibrations of vehicle structures; static aeroelastic problems (structural deformation, divergence, control effective-

ness, and reversal); flutter theory and calculation of flutter boundaries. aerodynamics of steady and nonsteady two-dimensional wings in subsonic, sonic, and supersonic flow; strip theory applications of two-dimensional aerodynamics to three-dimensional lifting surfaces; piston theory and Newtonian-flow theory. Prerequisite: ME 215, 221; or equivalent. (Fall)

224 Fundamentals of Combustion Engines (3)
Classification of combustion engines: air cycles, vapor cycles, external combustion engines, internal combustion engines; rotary engines, reciprocating engines, and turbomachinery; ideal cycle analysis; engine heat losses and friction; practical cycle analysis status of computerized cycle analysis. combustion and knocking; carburetion and fuel injection; mixture distribution; valve mechanism; ignition systems; combustion chamber; piston-engine, rotary-engine, and turbomachinery mechanics and balance. Prerequisite: approval of Department. (As arranged)

225 Turbomachinery I (3)
Turbine, compressor, and pump types and uses; dimensional analysis of turbomachines; cycle analysis of gas and steam turbines; energy interchange in fluid machinery; design, characteristics, and performance of turbines, compressors, and pumps; comparison of types of turbines, compressors, and pumps. Prerequisite: ME 221. (Fall)

226 Turbomachinery II (3)
Aerodynamics of aerofoils, flow in cascades, axial compressor aerodynamic design, axial turbine aerodynamic design, compressor and turbine matching. Combustion fundamentals, combustion chemistry, and gas turbine combustion chamber design. Prerequisite: ME 225. (Spring)

227 Viscous Flow (3)
Exact solutions of Navier-Stokes equations; the small Reynolds number approximations, laminar boundary-layer theory and the techniques for its solution, stability of laminar flows; Reynolds theory of turbulent stresses, applications to internal and external flows, turbulent boundary-layer theory; applications to heat transfer problems; flow separation. Prerequisite: ApSc 213; and ME 221 or equivalent. (Fall)

231 Hydrodynamics (3)
Flow at large Reynolds number: vorticity dynamics, Kelvin's theorem in inviscid flow, vorticity in motions generated from rest, boundary layers, applications of the momentum theorem. Irrotational flow theory: applications of Bernoulli and momentum theorems to steady flows, flow due to a rigid body, two-dimensional motion and applications of complex variable theory, free surface flows, Froude numbers, criterion of dynamic similarity. Effectively inviscid flow with vorticity: sheet vortex, flow with swirl, vortex system of a wing. Prerequisite: ME 221 or equivalent. (Spring)

235 Compressible Flow (3)
Thermodynamics and physical properties of gases, fundamental equations of a compressible inviscid fluid, small perturbation theory, expansions in Mach number and thickness parameters, second-order shock shapes, role of entropy in supersonic flow, shock wave interactions, holograph transformation, Kármán-Tsien and other model gases, conical flows, transonic flow theory, method of characteristics, rotational nonisentropic flows. Prerequisite: ApSc 213; and ME 221 or equivalent. (Spring)

237 Energetics of Fluid Flow I (3)
Energy transformations in fluid flows. Gas dynamics of combustion. Non-uniform flow, mixing. Mechanisms of flow induction. Applications to pumping, propulsion in water, air, and space, and thrust augmentation. Prerequisite: ME 155 or equivalent. (Spring)

238 **Energetics of Fluid Flow II** (3)
Wave processes and their utilization. Static, dynamic, and cryptosteady pressure exchange; energy equalizers and dividers. Advanced concepts of air and marine propulsion. Discussion of various concepts of flow induction, thrust generation, and environmental control. Prerequisite: ME 237 or equivalent. (Spring)

240 **Kinematic Synthesis** (3)
Techniques for the analysis and synthesis of function, path, and motion generating mechanisms. Algebraic and graphical methods for the dimensional design of mechanisms having prescribed performance characteristics. Design for higher-order requirements. Computer-aided techniques for the optimal design of planar linkages using Burmester theory, complex number stretch-rotation operators, Chebyshev polynomials, etc. Review of recent developments and current research. Term project. (As arranged)

241 **Engineering Systems Design** (3)
Principles of systems design; interdisciplinary system simulation for mechanical, electrical, fluid, and thermal sciences; dynamic response of systems; mathematical model and analogy studies; optimization techniques with computer-aided solutions. Prerequisite: approval of Department. (Spring)

242 **Advanced Mechanisms** (3)
Emphasis on spatial kinematics but with some attention to classical theorems of plane kinematics. Analysis and synthesis of mechanisms. Analytical techniques using matrices, dual numbers, quaternion algebra, finite and instantaneous screws, theory of envelopes. Applications to design of linkages, cams, gears, machined surfaces. Use of digital computers in mechanism analysis and design. Prerequisite: ME 240. (Fall, alternate years)

243 **Advanced Mechanical Engineering Design** (3)
Design of mechanical engineering systems, components, and equipment; requires the integration of engineering disciplines at an advanced level. Prerequisite: approval of Department. (Fall)

246 **Electromechanical Control Systems** (3)
System synthesis, compensation, and stabilization using Bode diagrams, root locus, etc.; linear and nonlinear characterization of mechanical, electromechanical, and electronic control components. Prerequisite: approval of Department. (Fall)

247 **Fluidics** (3)
Introduction of fluidic components and systems: behavior and modeling of bistable and proportional jet devices, vortex amplifiers and sensors, passive elements, transmission lines; system synthesis, coupling effects. Survey of current applications and research. Prerequisite: approval of Department. (Spring)

†248 **Seminar: Aircraft Design I** (3)
Designing an aircraft to specifications. Regulatory requirements, state-of-the-art limitations, computer-aided design, integration of aircraft components, economic considerations, and iterations to final configuration to obtain specified mission profile. Prerequisite: approval of Department. (As arranged)

†249 **Seminar: Aircraft Design II** (3)
Aircraft design in relation to prescribed mission requirements, different configurative concepts, detail design features. Estimation of weight, size,

† at NASA-Langley Research Center; may be offered on campus when arranged.

and power of an aircraft to satisfy mission specifications; design trade-offs and compromises. Emphasis on subsonic aircraft for steady cruising flight missions. Jet-powered and propeller-driven aircraft; supersonic cruising aircraft. Prerequisite: approval of Department. (Spring)

251 Advanced Electromechanical Control Systems (3)
Time domain analysis and design of electromechanical control systems using state space methods and matrix differential equation techniques. Advanced stability analysis and design optimization techniques for both linear and nonlinear systems. Examples taken from practical mechanical components and systems including continuous and discrete time systems. Introduction to electromechanical switching system theory and practice. Prerequisite: ME 246. (As arranged)

254 Intermediate Heat and Mass Transfer (3)
Fundamentals of heat and mass transfer, its laws and properties. Conduction equations and solutions for steady and transient cases. Convection of heat and mass. Dimensionless numbers and boundary layer concepts. Laminar, transition, and turbulent flows. Radiation in transparent media and at surfaces. Application to combustors and solar devices. Prerequisite: ApSc 213. (Spring)

255 Urban Transportation Technology (3)
An introduction to the technical evaluation of alternative transportation modes including bus, rail, and new technology. Includes system operations, energy and environmental impacts, route constraints, suspension and switching systems, life cycle costs, and measures of system effectiveness. Prerequisite: approval of Department. (Fall)

257 Energy Technology I (3)
An overall view of energy technology, supply and demand, and the relation among energy, environment, and institutional problems. Regression analysis, forecasting of supply and demand, energy systems modeling, analysis of cycles, Second Law analysis, nuclear energy, and energy transmission. Prerequisite: approval of Department. (Fall)

258 Energy Technology II (3)
Continuation of ME 257. Various forms of solar energy (e.g., heating and cooling, photovoltaics, wind, biomass, ocean thermal gradients), tidal energy, geothermal energy, energy and food production, energy systems design, and energy policy. Prerequisite: ME 257. (Spring)

259 Solar Heating of Buildings (3)
(Formerly Solar Heating and Cooling of Buildings)
Availability of solar energy, solar radiation data. Radiation characteristics of materials; methods of solar energy collection and storage. Theory of flat-plate collectors; flat-plate collector performance. Review of other types of collectors. Solar energy storage. System thermal calculations and experiments. Design of solar water heating and heating systems. Principles of passive solar heating. Solar process economics. Review of principles of solar cooling of buildings. Prerequisite: approval of Department. (Fall)

260 Heating and Air Conditioning of Buildings (3)
Basic concepts and engineering data including psychometrics and comfort conditions. Heating and cooling load calculations, computer programs for system design and for energy consumption analysis. Codes and standards for building energy management, energy conservation opportunities. Heating and air conditioning systems; all air, air and water, all water systems, central control systems. Cost estimates and economic analyses, life-cycle costing. Prerequisite: ME 187 or equivalent. (Spring)

261 Air Pollution I (3)
An introductory course on the generation, monitoring, and control of air pollution. Elements of the system: generation of particulate and gaseous pollutants in natural, industrial, and energy-generating systems; their transformation as they diffuse into the dynamic sun-irradiated atmosphere; assessment of their impact through monitoring and inventory of emissions sources. Effects on health and welfare on urban, regional, and global scales. Air pollution standard setting and control strategy development. Prerequisite: approval of Department. (Fall)

262 Air Pollution II (3)
Laboratory and field survey and assessment of air pollution problems. A variety of laboratory techniques will be used to measure actual ambient air quality, and laboratory and field sampling of pollutant levels inside and immediately outside combustion systems will be conducted. Diffusion and chemical models will be used to relate sources and sensors of air pollution. A field air pollution impact assessment project will culminate the course activity. Prerequisite: ME 261 or equivalent. (Spring)

263 Air Pollution Control Technology (3)
Theoretical and applied aspects of aerosol and gaseous emission control from both stationary and mobile sources. Aerosol controls: sedimentation, precipitation, filtration, and wet collection. Application of scrubbers, catalysts, and combustion modification to control of gaseous emissions from stationary sources. Special techniques for fine particulate control (fabric, electrostatics). Control of automotive emissions through engine modification, catalysts, and alternative power systems. Vapors, odors, and noise. Prerequisite: ME 261 or equivalent. (Spring)

264 Air Pollution Seminar (3)
Special interest and advanced topics not covered in ME 261, 262, or 263. Special lectures by individual experts. Participants will be required to conduct a special topic study for contribution to the seminar. Prerequisite: approval of Department. (Fall)

265 Air Pollution Meteorology (3)
Weather and motion systems of atmosphere; ground- and upper-level air conditions; atmospheric stability and inversions; atmospheric turbulence and diffusion; urban and topographic effects upon meteorological parameters; effects of meteorological parameters upon transportation and diffusion of pollutants; meteorological factors in plant location, design, and operation, and in urban planning. Prerequisite: ME 221 or equivalent. (Fall)

***269 Wind Tunnel Research Techniques** (3)
A comprehensive survey of wind tunnel research facilities and techniques; subsonic, transonic, supersonic, and hypersonic facilities; basic principles of wind tunnel design; associated research equipment including models, balances, instrumentation, and flow visualization techniques; data acquisition and reduction; research methods; static and dynamic testing techniques; powered-model testing; typical research data; significant research contribution. Prerequisite: approval of Department. (Spring)

***270 Aerodynamics of Flight Vehicles** (3)
Aerodynamic loads on flight vehicles, interference effects, application of aerodynamic theory to aircraft design, studies of aircraft dynamics and performance. Prerequisite: ME 222 or equivalent. (Spring)

* At NASA-Langley Research Center; may be offered on campus when arranged.

*271 **VTOL Aircraft Technology** (3)
Fundamental principles of VTOL aircraft; hovering performance based on momentum theory; analysis of jet-induced interference effects; transition aerodynamics; theoretical stability and control and correlation with flight data; ground-effect theory and experiment; handling qualities criteria, elements of instrument approach and landing problem. Prerequisite: approval of Department. (Spring)

*272 **Powered-Lift Technology** (3)
Basic principles of powered-lift aircraft; high-lift aerodynamics; low-speed stability and control; fundamentals of internally blown and externally blown powered-lift concepts; the spanwise blowing scheme to delay wing stall; use of powered-lift for improved maneuverability of fighter aircraft; aerodynamic ground effects; alleviation of noise of powered-lift systems; aerodynamic loads associated with blown flaps. Prerequisite: approval of Department. (Fall)

*273 **Principles of Automatic Flight Control** (3)
Design of aeronautical instrumentation and feedback controls; mathematical models of sensors, controllers, and actuators; theory of feedback control, stability, accuracy, and speed of response; equalization effects of nonlinearities and noise. Prerequisite: approval of Department. (Fall)

*274 **Principles of Flight Guidance** (3)
Guidance requirements for atmospheric flight; implementation of guidance systems using inertial and radio techniques in conjunction with automatic data processing. Prerequisite: ME 273. (Fall)

275 **Stability and Control of Vehicles** (3)
Derivation of equations of motion, Euler transformations and direction cosines, stability derivatives and linearization of equations of motion, stability of linear systems with application to longitudinal and lateral dynamics, Laplace transform techniques, and frequency response analysis. Prerequisite: approval of Department. (As arranged)

*276 **Mechanics of Space Flight** (3)
First- and second-order Hamilton-Jacobi perturbation theory applied to artificial satellites, von Zeipel's methods, special and general perturbation theories for third-body perturbations. Differential correction of orbits by weighted least squares and minimum variance techniques. Comparison of various filtering techniques as applied to orbit determination and other space flight parameter estimation. Prerequisite: approval of Department. (As arranged)

277 **Numerical Methods in Fluid Mechanics** (3)
Numerical solution of partial differential equations of fluid flow; finite-difference techniques for viscous and inviscid flows; stability; methods of characteristics; boundary conditions; applications in subsonic and supersonic flows. Prerequisite: ApSc 213, EngS 284; or equivalent. (As arranged)

*279 **Special Topics in Flight Sciences** (3)

280 **Intermediate Thermodynamics** (3)
Macroscopic and microscopic descriptions of thermodynamic systems. Fundamental equation; conditions of equilibrium and stability of thermodynamic systems. Review of methods of statistical thermodynamics, microstate, macrostate, and thermodynamic probability. Classical and quantum statistics. Properties of perfect gases and crystals. Review of elements of kinetic theory and transport phenomena. Chemical equilibrium and selected applications. Prerequisite: approval of Department. (Fall)

* Offered at NASA-Langley Research Center; may be offered on campus when arranged.

281 Nonequilibrium Thermodynamics (3)
Molecular theories of gases; thermodynamic properties and Boltzmann's integro-differential equation, the H-theorem and entropy; equations of state and potentials; the equation of change and velocity distribution outside equilibrium; transport properties. Field theory. Constitutive, balance, and Gibbs equations. Variational principles. Application to transport processes in engineering systems. Prerequisite: ME 280. (Spring, odd years)

282 Fossil Fuels (3)
Coal, petroleum, and natural gas. Fossil fuel reserves, methodologies of estimating and exploring for fossil fuels. Geophysical, geochemical, and satellite techniques. Prerequisite: Chem 152. (As arranged)

283 Nuclear Reactor Engineering I (3)
World energy resources and the importance of fission energy; atomic and nuclear structure; nuclear fission and chain reaction; critical mass; nuclear reactor classification; history of reactor development; nuclear reactions and radiations; radioactive decay; radiation detection, hazards, and protection; neutron reactions; neutron diffusion and slowing down; the criticality condition; reflected reactors; homogeneous and heterogeneous reactor systems; transient reactor behavior and control; description of pressurized and boiling water reactors; other reactor systems. Environmental considerations; reactor safety. Prerequisite: approval of Department. (Fall)

284 Nuclear Reactor Engineering II (3)
Energy removal; reactor coolants; reactor thermal hydraulics, radiation damage and reactor materials problems; reactor fuels; shielding; mechanical and structural components; preliminary reactor design; fuel cycles; description of nuclear reactor systems; engineered safety systems; the economics of nuclear power. Prerequisite: ME 283. (Spring)

***285 Reaction Kinetics (3)**
Theoretical aspects of kinetics of homogeneous and heterogenous reactions in gaseous and liquid systems. Prerequisite: ME 280. (Spring)

286 Special Topics in Mechanical Engineering (3)
Prerequisite: approval of Department. (As arranged)

287 Heat Conduction (3)
Conduction of heat through solid, liquid, and gaseous media; formulation and methods of analytical, numerical, and analog solutions; steady two- and three-dimensional problems, problems in unsteady heat conduction; conduction in composite regions. Prerequisite: ApSc 213 or equivalent. (Fall)

288 Convective Heat and Mass Transfer (3)
Heat and momentum transfer in laminar and turbulent flow; application of boundary-layer theory to problems of forced convection; the laminar boundary-layer and similarity solutions; heat convection in turbulent flow, momentum-heat transfer analogy; the influence of temperature-dependent fluid properties; convective heat transfer at high velocities; mass transfer; formulation of a simplified theory; some solutions to the conserved property equation. Prerequisite: ME 221 or equivalent. (Spring)

289 Radiative Heat Transfer (3)
Nature of thermal radiation; radiative characteristics of surfaces; thermal radiation within evacuated enclosures; configuration factors algebra; solution methods for the integral equations of radiant interchange; enclosures containing an absorbing and emitting medium; absorbing, emitting, and

* at NASA-Langley Research Center; may be offered on campus when arranged.

scattering media; combined radiation, conduction, and convection. Prerequisite: ApSc 214 or equivalent. (Fall)

*290 **Kinetic Theory of Gases** (3)
Equation of state and physical properties for gas composed of discrete particles; relation of kinetic theory to thermodynamics; Maxwell distribution of molecular velocities; Boltzmann H theorem. Molecular interactions, free paths, collision rates, scattering coefficients. Introduction to diffusion, viscosity, heat conduction; imperfect gases; flow of gases at low density. Prerequisite: ME 280. (Spring)

291–92 **Power Systems** (3–3)
Design of thermal power system components and system optimization. Steam cycle power generation system components: steam generators, reactor coolant system, condensate and feedwater system, turbine-generator, waste heat removal. Heat balance studies, options for improved cycle efficiencies, system optimization studies, component selection and design, cooling towers, lakes and ponds. Review of safety and pollution regulations; testing, inspection, and codes. Survey of electric power system technology. Prerequisite: ME 148, 187; or equivalent. (Academic year)

293 **Combustion** (3)
Basic combustion phenomena. Rate processes and chemical kinetics. Chain reaction theory. Detonation, deflagration, diffusion flames, heterogeneous combustion. Combustion technology, computer modeling, and experimental measurements. Impact of pollution regulations and alternate fuels. Prerequisite: approval of Department. (Spring)

294 **Wind Energy** (3)
Technical and economic problems of energy extractions from wind. Examination of the morphology of conversion devices; energy extraction from a moving fluid stream; aerodynamics of rotors. Nature of the wind, its special, temporal, and terrain-dependent variables. Structural, dynamic, and electrical problems and requirements; systems tradeoffs in wind turbine design. A wind turbine will be designed. Prerequisite: approval of Department. (As arranged)

295 **Statistical Thermodynamics** (3)
Distribution functions: Boltzmann, Bose-Einstein, and Fermi-Dirac statistics; partition functions, correspondence between classical and statistical thermodynamics. Systems with negligible effects of interparticle forces; perfect gases, perfect electron gas, photon gas. The Debye solid, the Einstein solid. Prerequisite: ME 280. (Spring, even years)

296 **Special Topics in Heat and Mass Transfer** (3)
Prerequisite: approval of Department. (As arranged)

297 **Special Topics in Fluid Mechanics** (3)
Prerequisite: approval of Department. (As arranged)

298 **Research** (arr.)
Research as arranged. May be repeated for credit. (Fall and spring)

299–300 **Thesis Research** (3–3)
(Fall and spring)

310 **Mechanics of Non-Newtonian Fluids** (3)
Classification of fluids; physical properties of composite fluids; convected coordinate systems; fundamentals of constitutive equations of composite fluids; purely viscous fluids, Reiner and Rivlin theories, power-law fluids; linear theory of viscoelastic fluids, Boltzmann principle, quasi-linear viscoelasticity; nonlinear theory of viscoelasticity, Rivlin-Ericksen theory; viscoplastic fluids, Bingham plastic fluids, Oldroyd's analysis; viscometry and rheogoneometry; turbulent flow of suspensions and emulsions in pipes;

* Offered at NASA-Langley Research Center; may be offered on campus when arranged.

frictional drag reduction by polymeric additives. Prerequisite: approval of Department. (Fall)

311 **Nonsteady Flow** (3)
Eulerian and Lagrangian kinematics. Fundamental equations of nonsteady viscous flow. Characteristics and waves; initial and boundary conditions. Piston theory and the oscillating airfoil. Nonsteady flows with entropy production. Discontinuities, interactions, and special transients. Gasdynamics of nonsteady combustion. Analogies and applications. Prerequisite: ME 235 or ME 237 or equivalent. (Fall)

312 **Theory of Turbulence** (3)
Concept of turbulence, transition and linear theory of flow stability, experimental observations on turbulence generation, turbulent kinetic energy distribution, statistical description of turbulence, energy cascade and energy spectrum in turbulence, mean turbulent energy and Reynolds stress closure models, turbulent shear flows in free turbulence and wall turbulence, turbulence in atmospherical environment and effects on air-pollution and weather systems, turbulent drag reduction. Prerequisite: ME 227. (Fall)

313 **Magnetofluidmechanics** (3)
Thermodynamics and fluid mechanics of electrically conducting liquids and gases; theory and applications; thermodynamics and transport properties of plasmas formulated; reaction kinetics and plasma reactions; fundamental equations (mass, momentum, and energy) of magnetofluidmechanics; flow with infinite and finite conductivity, Alfven waves and wave phenomena, flow with heat transfer and friction, relativistic magnetofluidmechanics, dimensional analysis and scaling parameters, applications to MHD power generators, pumps, plasma jets and propulsion, controlled thermonuclear fusion, chemical synthesis and mineral separation. Prerequisite: ME 221, 280. (As arranged)

315 **Hypersonic Flow** (3)
Small-disturbance theory, Newtonian theory; constant-density solution, theory of thin shock layers, flow over blunt bodies, hypersonic viscous flow. Prerequisite: ME 227. (Fall)

317 **Physical Gas Dynamics** (3)
Molecular and atomic phenomena in gases, intermolecular forces, specific heats, equation of state for a real gas, dynamics of dissociating gas, radiation. Prerequisite: ME 235; and ME 295 or equivalent. (Spring)

398 **Advanced Reading and Research** (arr.)
Limited to students preparing for the Doctor of Science qualifying examination. May be repeated for credit. (Fall and spring)

399 **Dissertation Research** (arr.)
Limited to Doctor of Science candidates. May be repeated for credit. (Fall and spring)

ineering Science Graduate Courses

201 **History of Technology I** (3)
The characteristic technologies of Prehistory, the Ancient Near East, Greece and Rome, Byzantium and Islam, and Christian Europe. Technology is broadly defined. Emphasis is on its manifold interactions with other cultural forces. (Fall)

*202 **Advanced General Metrology** (3)
Topics in the conceptual, physical, and mathematical aspects of measurement, standards, design for precision measurement, and measurement at extreme values. Prerequisite: graduate status. (Fall—evening)

red at NASA-Langley Research Center; may be offered on campus when arranged.

*203–4 **Probability and Statistics of Metrology** (3–3)
Probability distributions, discrete and continuous distributions; sampling; combinatorial analysis; stochastic processes; conditional probability; correlation; analysis of variance; design and analysis of experiments; Latin Square experiments; factorial experiments; block and lattice design. Prerequisite: ApSc 115 or equivalent. (Academic year—evening)

206 **Technology and Human Needs** (3)
Sociology of science and technology, the solar systems and earth, population, nonrenewable resources, renewable resources, energy, nuclear energy, renewable energy conversion, environment, productivity, transportation. Prerequisite: approval of Department. (Fall and spring)

207 **Engineering Climatology** (3)
Constitution of physical properties of earth and atmosphere, stability conditions, energy balance characteristics, atmospheric motions, storm forecasting models, tree-ring analysis, evaporation, precipitation, fog formation, soil moisture, ground frost. Prerequisite: approval of Department. (As arranged)

208 **Energy Conservation** (3)
Methods of conserving energy without sacrificing productivity and the quality of life. Conservation methods in the home, in transportation, in industrial, manufacturing, and commercial sectors. Second law of thermodynamics from a conservation viewpoint. Construction methods for low-energy consumption in large and small edifices. Environmental effects and low-fuel consumption in ground and air transportation. Greenhouses and natural fertilizers. Prerequisite: approval of Department. (As arranged)

210 **Quantitative Aspects of Social Phenomena** (3)
Mathematical models presenting social phenomena. Historical review of attempts to quantify social phenomena. Population growth, birth and death rates; population diffusion; Lancaster equation; Richardson's approach; the Forrester-Meadows model. Kinetic theory formulation of peaceful co-existence. Probability distributions, characteristic functions, and central limit theorem. Brownian motion approach to speculation and the stock market. Traffic flow, the statistical approach and Lighthill's method. Quality-of-life indicators and quantification of social indicators. Environmental modeling. Thermodynamics approach to self-rejuvenating systems and its application in government and organizations. Prerequisite: approval of Department. (As arranged)

212 **Nonrenewable Resources** (3)
Interplay of geology, engineering, and economics on resources. Role of resources in society, concepts and definitions for analyzing resource issues. Mineral commodities, their world distribution, geology, production technologies and costs, transportation systems, consumption patterns, substitutes, recycling. Environmental impacts, energy requirements, needs, and problems in mineral conservation; the threat of mineral cartels. Analysis of optimistic and pessimistic forecasts of future resource depletion. Prerequisite: approval of Department. (As arranged)

213 **Renewable Resources** (3)
Food and fiber, solar energy and radiation, photosynthesis. Agricultural and forest biomass production, seasonal availability, collection and replanting. Substitution of renewable resources for depletable. Food-energy relationship. Biological and chemical conversion processes, direct combustion, pyrolysis, enzymatic hydrolysis, and hydrogenation. Economics of scale and life cycle cost of conversion systems. Environmental and

*Offered at NASA-Langley Research Center; may be offered on campus when arranged.

socio-economic impacts of alternative land usage. Institutional barriers. Prerequisite: approval of Department. (As arranged)

214 **Geothermal Energy** (3)
Geothermal energy due to thermal gradients in the earth, fundamentals of geological gradients, geographic location of potential geothermal energy sources, comparison of methods of exploration and study of steam and hot rock systems. Generation of electricity from geothermal sources. Obtaining hot water process heat. Equipment design. Environmental effects and means of mitigating adverse conditions. Prerequisite: approval of Department. (As arranged)

215 **Advanced Strength of Materials** (3)
Advanced problems of stress and strength analysis of structural and machine elements: bending, torsion and buckling of thin-walled structures. Curved beams, stress-concentrations, thermal stresses, creep instability and stress relaxation, contact problems, composite elements. Prerequisite: approval of Department. (Spring)

217 **Analytical Mechanics** (3)
Fundamental principles, generalized coordinates, variational principles and Lagrange's equations, nonholonomic systems, Hamilton's equations, theory of small oscillations. Prerequisite: approval of Department. (Fall)

218 **Introduction to Continuum Mechanics** (3)
Kinematics of a continuum, equations of motion, linear isotropic elastic solid, Newtonian viscous fluid, integral formulation of general principles, simple applications. Prerequisite: approval of Department. (Fall)

221 **Theory of Elasticity I** (3)
Introduction to Cartesian tensor analysis; deformation, stress, linear constitutive relations, formulation of boundary value problems, variational principles; torsion and bending of prismatical rods, plane problems in elastostatics. Prerequisite: approval of Department. (Spring)

222 **Theory of Elasticity II** (3)
Application of integral transforms and analytic function theory to solution of plane problems in static and dynamic elasticity. Introduction to three-dimensional elastostatics. Prerequisite: EngS 221, ApSc 211. (Fall, odd years)

228 **Physical Oceanography** (3)
Seawater, equations of motion, interaction between air and sea, currents, wind-waves in deep and shallow waters, long ocean waves, tides, wave-statistics, sea ice. Prerequisite: ME 221 or equivalent. (Spring)

229 **Transformations in Materials** (3)
Thermodynamics of solids, statistical interpretation of entropy, lattice defects, equilibrium in multicomponent systems, rate theory, diffusion, phase transformations, nucleation and growth, precipitation, martensitic transformations. Prerequisite: approval of Department. (Spring, odd years)

230 **Deformation of Materials** (3)
Dislocation geometry, stress field of dislocations, forces on a dislocation, dislocation reactions, dislocation dynamics, yield, plastic flow, work hardening, recovery, solid solution hardening, precipitation and dispersion hardening, mechanisms of creep, yield, and fracture. Prerequisite: approval of Department. (Fall, odd years)

231 **Structure of Materials** (3)
Space lattices, crystal structures, planes, directions, anisotropy, texture and preferred orientations, stereographic projections, Bragg's law, Laue techniques, moving crystal diffraction, Debye-Scherrer method, X-ray spectrometry, electron microscopy, bonding energy of crystals, lattice energy, lattice vibrations, free electron theory, zone theory, alloy theories,

conductors, insulators and semiconductors, magnetism, resistivity, defects in metals. Prerequisite: approval of Department. (Fall, even years)

223 **Mechanics of Composite Materials** (3)
Stress-strain relationship for orthotropic materials; invariant properties of an orthotropic lamina; biaxial strength theory for an orthotropic lamina; mechanics of materials approach to stiffness; elasticity approach to stiffness; classical lamination theory; strength of laminates; statistical theory of fatigue damage for composites. Prerequisite: approval of Department. (Spring, odd years)

234 **Composite Materials** (3)
Principles of composites and composite reinforcement; micromechanics and failure; interface reactions in various composites; reinforcing materials; structure of composites—fiber-reinforced polymers, filler-reinforced polymers, fiber-reinforced metals, directionally solidified alloys, dispersion-strengthened metals. Prerequisite: approval of Department. (Spring, even years)

236 **Experimental Techniques in Materials Science** (3)
Sample preparation. Optical microscopy including polarized light methods, phase contrast, interferometry. X-ray microscopy including Laue technique and Debye-Scherrer method. Electron probe microanalysis. Electron microscopy including electron optics, image formation and contrast for scanning and transmission electron microscopy. Field ion microscopy. Prerequisite: approval of Department. (Spring, even years)

237 **Environmental Effects on Materials** (3)
Aqueous corrosion, electrochemistry, electrochemical reactions, polarization, environmental factors, integranular corrosion, stress corrosion, high temperature corrosion, kinetics and mechanisms of corrosion, oxidation, liquid metal corrosion, irradiation effects. Prerequisite: approval of Department. (Fall, even years)

*239 **Physical Ceramics** (3)
Crystal chemistry and the systematic study of the structure of ceramic materials; solid reactions occurring at elevated temperatures; sintering, vitrification, diffusional mechanisms and effects; reaction rate theory; elastic, anelastic, and plastic properties of ionic and covalent solids; viscoelastic behavior of vitreous and vitreous-solid systems; phase equilibria of ceramic systems. Prerequisite: approval of Department. (Spring)

240 **Fracture Mechanics** (3)
Fundamentals of brittle fracture, Griffith theory and extensions, mechanics of fracture, linear elastic systems, plasticity considerations, fracture toughness, engineering analysis, notch strength analysis with limit approach, crack propagation laws, fatigue, fracture testing, comparison of recent continuum theories. Prerequisite: EngS 221 or CE 261. (Spring, even years)

241 **Failure of Materials** (3)
Tensile and shear deformation, yield, dislocation motion, geometry of slip, single and polycrystal deformation, twinning, creep deformation, polymer deformation, fracture, Griffith Theory, fracture toughness, transition temperature, microstructure effects, environmental effects, stress corrosion cracking, cyclic stress and strain, fatigue crack initiation and propagation, statistical analysis, low cycle fatigue, failure analysis. (Fall, odd years)

242 **Materials Recycling and Recovery** (3)
Techniques and technologies for recovering and re-using waste materials and developing low-resource waste systems. Direct relationships of re-

*Offered at NASA-Langley Research Center; may be offered on campus when arranged.

cycling and waste reduction to energy conservation. Effect of recycling on energy and environmental impacts of alternative materials and products; legal, economic, institutional, and environmental policy aspects of recycling and waste reduction. Prerequisite: approval of Department. (Spring)

*249 **Special Topics in Materials Science** (3)
Prerequisite: approval of Department. (As arranged)

251–52 **Transportation Workshop** (3–3)
Students and staff from various disciplines are brought together for study of a selected transportation topic, or for study of the land-use objectives and transportation needs of a selected urban area and a survey of pertinent information and applicable solutions. Prerequisite: approval of Department. (Academic year)

253 **Operational Control of Urban Transit Networks** (3)
General discussion of the essential functions of operation and control for various systems, with emphasis on the automation of these functions. Regulation of roadway traffic flow, management of public transit fleets, and automatic control of subways and of automated guideway transit systems. Prerequisite: approval of Department. (Spring)

256 **Introduction to the Theories of Inelastic Media** (3)
Physical basis of anelasticity, viscoelasticity, plasticity, and viscoplasticity; constitutive equations of elastic and viscoelastic media; foundations of the theories of plasticity and viscoplasticity; boundary-value problems and wave propagation in inelastic media. Prerequisite: ApSc 213 or equivalent and approval of Department. (Spring, odd years)

259 **Random Vibration of Structures** (3)
Introduction to random processes; responses of linear structures to stationary and nonstationary random inputs; structural responses to earthquakes, waves, boundary layer turbulences, wind loads, etc.; failure analysis of structures under random loads; first passage failure, fatigue, stress-corrosion and crack propagation under random stress histories. Prerequisite: ApSc 115 or CE 253. Prerequisite or concurrent registration: CE 252 or ME 215. (Spring)

260 **Random Process Theory in Engineering** (3)
Spectral analysis, linear system, the superposition principle; statistical prediction and probability function, Rayleigh distribution and its properties, threshold crossing problems, prediction of extreme values; statistical prediction of random vibration, application to civil and mechanical engineering. Prerequisite: ApSc 115 or equivalent. (Fall)

*263 **Atmospheric Physics for Engineers I** (3)
Atmospheric radiation: phenomenological equation of transfer; solutions to the transfer equation; optical, physical, and chemical properties of atmospheric constituents; remote sensing and the direct inversion problem; energy transfer and atmospheric structure. Prerequisite: approval of Department. (As arranged)

*264 **Atmospheric Physics for Engineers II** (3)
Atmospheric dynamics; mean structure of the atmosphere, temperature, pressure, and wind fields; mass, momentum, and energy transfer; large-scale features of atmospheric circulation; regional features of atmospheric circulation; micrometerology. Prerequisite: approval of Department. (As arranged)

270 **Theoretical Acoustics I** (3)
Basic acoustic theory in stationary and uniformly moving media; waves in infinite space; sound transmission through interfaces between layered

ffered at NASA-Langley Research Center; may be offered on campus when arranged.

media and between media in relative motion; sound radiation from simple solid boundaries, source and dipole fields; propagation inducts and enclosures; elements of classical absorption of sound. Prerequisite: ME 221, ApSc 213, or equivalent. (As arranged)

*271 **Random Process Theory I** (3)
Random processes; stationarity and ergodicity; mean-square calculus; auto- and cross-correlations and spectra; random processes in linear systems; mean-square estimation, prediction and filtering; zero and level crossings and peak distributions; applications in aerospace sciences. Prerequisite EngS 203 or approval of Department. (As arranged)

*272 **Random Process Theory II** (3)
Discrete and continuous state Markov-processes; chains, queues, diffusion, and passage problems; linear and nonlinear estimation and stochastic control; estimation of correlations and power spectra; applications in communication theory; scattering from random surfaces; stochastic linearization and stability. Prerequisite: EngS 271. (As arranged)

*273 **Time Series Analysis** (3)
Harmonic analysis of deterministic and random signals; auto- and cross-correlations and spectra; coherence; modern techniques for spectral estimation including periodogram, Blackman-Tukey, direct filtering, maximum entropy, and maximum likelihood; fast Fourier transform and zoom FFT; effects of finite length and digitization on bias and variability; spectral analysis with randomly sampled data; digital filtering; applications in modern technology. Prerequisite: EngS 271 or approval of Department. (As arranged)

274 **Environmental Noise Control** (3)
Introduction to the physical effects of noise and vibration on man, practical sources of noise and their control; building noise, ventilation system noise, mechanical equipment noise, aircraft noise; automobile and truck noise; factors affecting vibration levels and vibration control by structural design, damping, and isolation. Prerequisite: EngS 270, ME 215. (As arranged)

*275 **Theoretical Acoustics II** (3)
General theory of sound propagation in homogeneous media, viscous and heat conduction effects; methods of solving the inhomogeneous wave equation; theory of sound radiation, sources, dipoles, quadrupoles; radiation from moving sources; scattering and diffraction of sound by obstacles; introduction to acoustics of inhomogeneous media, geometric acoustics. Prerequisite: EngS 270. (As arranged)

*276 **Acoustical and Mechanical Measurements** (3)
Characteristics of signals, basic transducer elements, standards of measurements and calibrations, signal recording and processing, acoustical and vibration instrumentation, vibration exciters, vibration testing techniques, flow mechanical measurements. Prerequisite: EngS 270, ME 215. (As arranged)

*277 **Physical Acoustics** (3)
Concepts of continuum mechanics and thermodynamics, wave propagation in real media, thermal viscous and relaxational attenuations, piezoelectric crystals and ultrasonics, wave propagation in rigid and deformable porous media. Prerequisite: EngS 275. (As arranged)

*278 **Psychological and Physiological Acoustics** (3)
Auditory system and its response to sound, experimental methodology in psychoacoustics, subjective response to sound, environmental noise and its evaluation, criteria for the prediction of noise nuisance, nonauditory

* Offered at NASA-Langley Research Center; may be offered on campus when arranged.

system response to noise. Prerequisite: approval of Department. (As arranged)

*279 **Human Factors in Engineering** (3)
Man-machine interface, effects of physical stress on human behavior and performance, life support system, learning and conditioning of physical stress. (Spring)

*280 **Special Topics in Acoustics** (3)
Current methods and problems in acoustics. Topics chosen from such areas as aerospace noise generation and control; instruments and procedures for acoustics measurements; and responses of structures, people, and communities to noise. Prerequisite: approval of Department. (As arranged)

*281 **Advanced Programming Techniques for Engineering Mechanics Problems** (3)
Techniques for efficient construction of large computer programs for engineering systems with emphasis on fundamental structured programming principles. Application to engineering mechanics systems such as finite elements and structural optimization. Effects of CPU organization and other hardware features of computer systems at NASA-Langley on numerical computations involved in engineering systems. Organization and management of data bases for large engineering mechanics systems. Prerequisite: approval of Department. (Spring)

282 **Computer-aided Design** (3)
Fundamental concepts in the development of computational algorithms for the design of structures, machine component and assemblies, and other engineering systems. Representation of the design process and design specifications as a network of decision tables and logical flags. Optimization techniques and algorithms in design applications. Interactive computer-aided design methods based on the use of remote access computer terminals. General purpose computer programs for engineering analysis and design. Students, individually or in groups, are required to develop a small-scale general-purpose design program in an appropriate area such as structural design, machine design, urban planning, environmental quality control, etc. Prerequisite: EE 51 or equivalent, and CE 210 or equivalent, and approval of Department. (Fall)

283 **Application of Computer Graphics in Engineering** (3)
Curve-fitting techniques as applied to computer graphics; construction of a library of geometric lines and curves connecting a series of discrete points. Representation of two- and three-dimensional geometrical shapes by a set of discrete points. Automatic generation and display on CRT screen of geometrical shapes consisting of a grid of discrete points interconnected by user-selected geometric shapes. Automatic mesh generation, transformations, projections, and the concept of "hidden" lines. Use of remote computer terminals and graphic plotter equipment in interactive computer-graphics applications. Prerequisite: EE 51 or equivalent, and EngS 284 or equivalent. (Spring)

284 **Numerical Methods in Engineering** (3)
Uses of computers in engineering and science; numerical interpolation, integration and differentiation; least squares approximations and application to data fitting; roots of polynomials; eigenvalue and eigenvector problems; solution of systems of linear equations; ordinary differential equations; introduction to solution of partial differential equations; applications to initial and two-point boundary value problems in engi-

*ered at NASA-Langley Research Center; may be offered on campus when arranged.

neering mechanics and other areas of engineering. Prerequisite: approval of Department. (Fall)

285 **Finite Element Methods in Engineering Mechanics** (3)
Formulation of the finite element method through variational principles for structural and continuum mechanics problems. Plane stress, plane strain, three-dimensional elasticity, plate bending, thermal conduction, and potential flow. Techniques of constructing and assembling characteristic elemental matrices, computer implementation of the finite element method. Prerequisite: approval of Department. (Spring)

*286 **Analysis and Design of Thin-walled Structures** (3)
Statics of thin-walled beams and panels, force interplay between stiffeners and skin in the analysis and design of stiffened thin-walled structures; strength and stiffness of locally buckled stiffened structures; classification of loads and safety factors; different considerations governing the design of thin-walled structures; critical evaluation of various structural design procedures. Prerequisite: approval of Department. (As arranged)

*287 **Automated Design of Complex Structures** (3)
Review of techniques for automated design including mathematical programming, fully stressed design, and optimality criteria; application of automated design techniques to stiffened and composite shell-type structures; multiple-load conditions and design constraints. Prerequisite: approval of Department. (As arranged)

288 **Advanced Finite Element Methods in Structural Mechanics** (3)
Formulation of various finite element models in solid mechanics. Examination of errors, convergence characteristics. Application to nonlinear and dynamic problems including large deflection, stability, and inelastic problems. Recent developments of finite element methods. Prerequisite: EngS 285. (As arranged)

289 **Special Topics in Theoretical and Applied Mechanics** (3)
Prerequisite: approval of Department. (As arranged)

298 **Research** (arr.)
Basic research projects as arranged. May be repeated for credit. (Fall and spring)

299–300 **Thesis Research** (3–3)
(Fall and spring)

*310 **Aeroacoustics** (3)
General theory of aerodynamic sound generation and propagation, Lighthill's formulation of jet noise, similarity laws, supersonic and subsonic jet noise, boundary layer noise, fan and compressor noise, helicopter noise, sonic booms. Current problems in aeroacoustics. Prerequisite: EngS 275. (As arranged)

*311 **Nonlinear Acoustics** (3)
Finite amplitude waves and waves in moving stratified media. Interaction between linear and nonlinear waves, wave propagation through nonlinear media, applications to transmission of sound through ducts with flow and absorbing walls. Prerequisite: approval of Department. (As arranged)

*312 **Theory of Random Vibration** (3)
Response of linear systems to stationary random inputs. Failures resulting from dynamic response. Response of space vehicle structures to intense noise fields, measurement, and application. Prerequisite: EngS 271, ME 215. (As arranged)

*313 **Structural Acoustic Interaction** (3)
Coupled response of structures to sound, system of infinite extent, system of finite extent, sound radiation from structure, sound transmission through

* Offered at NASA-Langley Research Center; may be offered on campus when arranged.

structure. Panel response to turbulent boundary-layer excitation. Sound radiation from mechanically excited structure vibration. Prerequisite: EngS 270, 312. (As arranged)

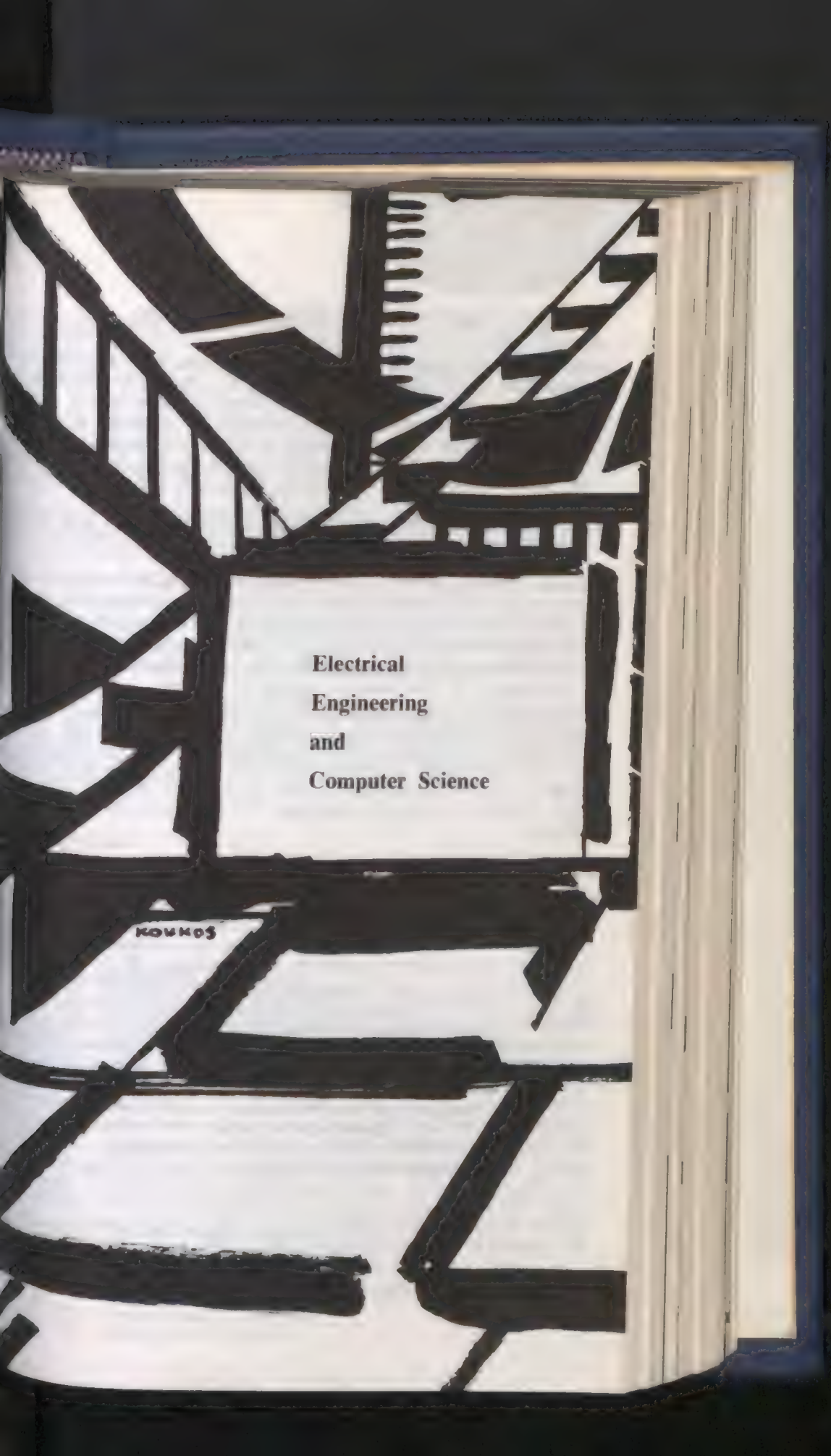
314 **Advanced Numerical Methods in Engineering** (3)
Advanced methods for numerical solution to engineering problems: finite difference solutions to elliptic, parabolic, and hyperbolic equations, method of characteristics, implicit and explicit initial value methods and their stability, optimization and mathematical programming methods, numerical solutions to integral equations, selected topics for fourth-generation computers. Prerequisite: EngS 284, ApSc 213. (Spring)

315 **Introduction to Nonlinear Mechanics of Continua** (3)
Polar decomposition, invariance, isotropy, representation theorems for invariants and isotropic tensor functions; deformation, kinematics, stress, balance principles; principles for constitutive relations; applications to nonlinear elasticity and non-Newtonian fluids. Prerequisite: ApSc 212. (Spring)

398 **Advanced Reading and Research** (ARR.)
Limited to students preparing for the Doctor of Science qualifying examination. May be repeated for credit. (Fall and spring)

399 **Dissertation Research** (ARR.)
Limited to Doctor of Science candidates. May be repeated for credit. (Fall and spring)




Electrical
Engineering
and
Computer Science
KOUNDS

Electrical Engineering and Computer Science

Professors A. Abd-Alla, R.B. Heller, A.C. Meltzer, M.F. Eisenberg, W.K. Kahn, P.M. Kelly *(Research)*, R.H. Lang, R.L. Pickholtz, T.N. Lee, W.D Maurer, H.J. Helgert, J.D. Foley, A.D. Friedman *(Chairman)*

Professorial Lecturers J.M. Aein, W.T. Bisignani, J.T. Coleman, P.J. Crepeau, W.F. Croswell, G. Frenkel, D. Hogan, S. Karp, E.M. Lipsey, M.J. Marcus, T.P. McGarty, S.A. Musa, L. Scharff, K.R. Shah, J.E. Shore, R. Triplett, W. Wasylkiwskyj, A.A. Wolf, H-L.A. Hung, L.F. Pau, S.H. Durrani, W. Eisner

Associate Professors E.H. Braun, N. Kyriakopolous, P.S. Bock, M.B. Feldman, L.J. Hoffman, M.H. Loew, R.L. Carroll, Jr., R.J. Harrington, S.Y. Berkovich, J.L. Sibert *(Research)*, D.C. Rohlfs

Associate Professorial Lecturers J.G. Adler, C. Alexander, Jr., J.W. Benoit, P.D. Bergstrom, J.H. Carson, H. Carus, C-K. Cho, S. Das, C.E. Dunham, A.S. Gill, J.A. Knight, L.M. Leibowitz, D.M. LeVine, G.E. Lyon, C.F.H Manders, F.P. Pantuso, F.J. Ricci, D.C. Roberts, L.A. Rubin, A. Schneider, J.R. Silverman, C.C. Wang, W.W. Wu, A. Zachai, R.M. Zeskind, C.R. Ammerman, G.J. Kowalski, R.J. Leopold, J.L. Torres

Assistant Professors M.E. Zaghloul, S.C. Chang, A.Z. Baraniecki *(Visiting)*

Assistant Professorial Lecturers R.D. Angelari, T.M. Bottegal, F.M. Brosi, Jr., Y. Chang, T. Collins, N. Dressner, D. Engel, R. Evans, P.J. Fox, M. Fritts, Y. Fu, M.S. Gluck, T. Husson, S.H. Kaisler, P.A. Lamb, D.D. Leondorf, E.H. Neal, A.F. Manfredi, Jr., D.H. Pugh II, R. Shankar, D.R. Smith, A.I. Breitler, J. Hsing, G. Lawrence, G. Leiderman, K. Schmucker, J.J. Seppy

UNDERGRADUATE STUDY

Electrical engineering as an engineering discipline is concerned with mastering a knowledge of electricity. Electrical engineers design generators, which provide electrical energy for homes and factories, and transmission networks and the motors which utilize this power to drive machinery. By developing electromagnetic radiation, electrical engineers produce radio waves for the propagation of radio and television signals and the transmission of information via satellites. Electrical engineers design and develop electronic circuits used in communications equipment and computers. These machines have enhanced our thinking and computational capabilities to permit mankind to solve some of its most complicated problems. Microminiaturization of electronic components has permitted the development of handheld calculators and portable communication equipment. Electrical engineers are developing new instrumentation to assist the medical profession in understanding the causes of disease and to aid in preserving and prolonging life. The production of electricity from nuclear power and control of nuclear power plants is of growing concern to electrical engineers. The world's primary energy sources are limited, and electrical power has become an even more important resource. Electrical engineers are involved in the research to produce electrical energy directly from solar power.

Electrical engineering is a branch of engineering in which practical as well as theoretical and scientific aspects are integrated into a well-balanced discipline.

Basic sciences such as physics and mathematics form the roots on which electrical engineering builds to create an applied science and to develop problem-solving techniques. Analysis, synthesis, and design go hand in hand. The electrical engineering curriculum provides the student with such an integrated approach. The first two years of the curriculum are common to all undergraduate fields in the School and allow students to develop a sound foundation of basic sciences coupled with engineering sciences. The third year continues with engineering sciences and begins an in-depth study of electrical engineering. The fourth year is devoted totally to electrical engineering. At the beginning of the fourth year the student has a choice of either following the regular electrical engineering curriculum or branching off into an area of concentration in computer science or in premedical engineering.

The Department of Electrical Engineering and Computer Science has modern laboratory equipment, including its own computer. The student has an opportunity during the last year to work on individual projects where ingenuity, coupled with faculty advice and guidance, allows concentration in areas such as computers, communications, microwaves, controls, electronics, medical engineering, and circuits.

Course schedules have been arranged to accommodate the full-time, the part-time, and the co-op student. Undergraduate courses are offered once a year during the day for full-time students, and once every two years in the evening for part-time students.

Subject Areas

COMMUNICATIONS

EE 143: Elements of Communication Engineering Design I
EE 144: Elements of Communication Engineering Design II
EE 146: Communications Laboratory

COMPUTER SCIENCE

CSci 51: Applications of Computers
CSci 52: Computers and Societal Problems
CSci 100: Introduction to Computer Science
CSci 150: Introduction to Microcomputers
CSci 151: Introduction to Systems Programming I
CSci 153: Design of Switching Systems
CSci 154: Digital Computer Design
CSci 155: Introduction to Numerical Methods for Computers
CSci 156: Introduction to Systems Programming II
CSci 157: Machine and Assembly Language Programming
CSci 158: Algorithmic Methods and High-level Languages
CSci 159: Programming and Data Structures
CSci 166-67: Computer Science Laboratory I and II

CONTROLS, SYSTEMS, AND POWER

EE 166: Power Systems Laboratory
EE 172: Control Systems Design
EE 176: Control Systems Laboratory
EE 177: Electrical Energy Conversion
EE 178: Electrical Power Systems

ELECTRONICS

EE 20:	Introductory Engineering Electronics
EE 121:	Engineering Electronics and Design
EE 122:	Pulse and Waveshaping Electronic Design
EE 124:	Electronic Devices
EE 169:	Advanced Electronics Design Laboratory

FIELDS AND WAVES

EE 31:	Fields and Waves I
EE 32:	Fields and Waves II
EE 133:	Electromagnetic Waves and Microwave Systems Design
EE 168:	Microwave and Laser Engineering Laboratory

LABORATORIES AND MEASUREMENT

CSci 163:	Senior Electrical Engineering Project Laboratory I
CSci 164:	Senior Electrical Engineering Project Laboratory II
EE 63:	Instrumentation and Networks Laboratory
EE 65:	Introductory Electronics Laboratory
EE 66:	Digital Electronics Design Laboratory
EE 67:	Switching Circuits Laboratory
EE 163:	Senior Electrical Engineering Project Laboratory I
EE 164:	Senior Electrical Engineering Project Laboratory II

MEDICAL ENGINEERING

EE 184:	Medical Engineering Instrumentation and Systems Design
EE 186:	Medical Engineering Laboratory

NETWORKS

EE 11:	Linear Networks I
EE 12:	Linear Networks II
EE 113:	Network Analysis and Design
EE 116:	Introduction to Network Synthesis

Core Curriculum

Normally the first four semesters are common to all undergraduate fields in the School of Engineering and Applied Science.

First Semester

BiSc 11:	Introductory Biology for Science Majors (4) (Pre-Med only)
EE 51:	Applications of Computers (3)
*Math 30–31:	Precalculus and Single-Variable Calculus I (3)
or	
Math 31:	Single-Variable Calculus I (3)

*Transfer students who have not successfully completed a college-level calculus course with a grade of *C* or better from an accredited institution, or high school students who did not take an advanced placement (AP) calculus course and receive a score of 4 or 5 on the AP test, will be required to take a one-hour locally administered math placement test at registration. This test covers algebra, trigonometry, and graphs. Students who do not place directly into Math 31 as a result of this test will be required to undertake a combined pre-calculus and calculus course (Math 30–31) during their first semester; this combined course meets five hours per week and carries three semester hours of credit if the student successfully completes the second half (Math 31) of the combined course.

Phys 3:	Foundations of Physics (3)
Engl 9 or 10:	English Composition: Language as Communication (3)
Elective:	Selected from humanities or social sciences (3) (Except Pre-Med)

Second Semester

BiSc 12:	Introductory Biology for Science Majors (4) (Pre-Med only)
EE 52:	Computers and Societal Problems (3)
*Math 32:	Single-Variable Calculus II (3)
*Math 33:	Multivariate Calculus (3)
Phys 14:	Introductory Mechanics and Thermal Physics (3)
Elective:	Selected from humanities or social sciences (3) (Except Pre-Med)

Third Semester

ApSc 57:	Analytical Mechanics I (2)
ApSc 113:	Engineering Analysis I (3)
ApSc 115:	Engineering Analysis III (3)
Chem 13:	General Chemistry (4)
Phys 15:	Elements of Electricity and Magnetism (3)
Elective:	Selected from humanities or social sciences (3)

Fourth Semester

Chem 22:	Introductory Quantitative Analysis (4) (Pre-Med only)
ApSc 58:	Analytical Mechanics II (3)
ApSc 114:	Engineering Analysis II (3)
CE 140:	Materials Science (3)
EE 11:	Linear Networks I (3)
Phys 16:	Introduction to Modern Physics (3)
Elective:	Selected from humanities or social sciences (3) (Except Pre-Med)

ctrical Engineering Curriculum

Fifth Semester

EE 12:	Linear Networks II (3)
EE 20:	Introductory Engineering Electronics (3)
EE 31:	Fields and Waves I (3)
EE 63:	Instrumentation and Networks Laboratory (1)
EE 65:	Introductory Electronics Laboratory (1)
EE 157:	Machine and Assembly Language Programming (3)
Elective:	Selected from humanities or social sciences (3)

Sixth Semester

CSci 153:	Design of Switching Systems (3)
EE 32:	Fields and Waves II (3)
EE 66:	Digital Electronics Design Laboratory (1)
EE 67:	Switching Circuits Laboratory (1)
EE 122:	Pulse, Digital, and Waveshaping Electronic Design (3)
EE 177:	Electrical Energy Conversion (3)
Elective:	Selected from humanities or social sciences (3)

th 32 and Math 33 are normally taken in a one-semester combined course, Math 32-33.

Seventh Semester

EE 121:	Engineering Electronics and Design (3)
EE 143:	Elements of Communication Engineering Design I (3)
EE 163:	Senior Electrical Engineering Project Laboratory I (1)
Elective:	Technical electives (9) (three courses selected from EE 113, 133, 150, 155, 178; ME 131, 187)
Elective:	Select one laboratory (1 credit) from CSci 166, EE 166, 168, and 169

Eighth Semester

EE 144:	Elements of Communication Engineering Design II (3)
EE 164:	Senior Electrical Engineering Project Laboratory II (1)
EE 172:	Control Systems Design (3)
Elective:	Technical electives (5) (two courses selected from EE 116, 124, 160, 165, 179, 184; ME 194)
Elective:	Select one laboratory (1 credit) from EE 146, 176, 186, and CSci 167

Technical Electives

CSci 166–67:	Computer Science Laboratory I and II (1–1)
EE 113:	Network Analysis and Design (3)
EE 116:	Introduction to Network Synthesis (3)
EE 124:	Electronic Devices (3)
EE 133:	Electromagnetic Waves and Microwave Systems Design (3)
EE 146:	Communications Laboratory (1)
EE 150:	Introduction to Microcomputers (3)
EE 155:	Introduction to Numerical Methods for Computers (3)
EE 160:	Electrical Measurements and Instrumentation (3)
EE 165:	Senior Design Project (2)
EE 166:	Power Systems Laboratory (1)
EE 168:	Microwave and Laser Engineering Laboratory (1)
EE 169:	Advanced Electronics Design Laboratory (1)
EE 178:	Electrical Power Systems (3)
EE 179:	Electrical Machine Control (3)
EE 184:	Medical Engineering Instrumentation and Systems Design (3)
EE 186:	Medical Engineering Laboratory (1)
ME 131:	Thermodynamics (3)
ME 187:	Heat Transfer Theory (3)
ME 194:	Energy Conversion (3)

Computer Science Option

Computer science is a developing discipline which combines electronic design, programming of computers, and mathematics into one comprehensive area. The student learns the design and utilization of computers for scientific and business applications. Students who complete this option will be able to design both hardware and software needed for minicomputer and large-scale computing systems. The student will also be competent in hardware and software utilization of computers for control of large systems. The curriculum prepares the student for a career in computer design, applications, and utilization, or to continue study in graduate school.

Prerequisite: first four semesters as described in the Core Curriculum, see pages 122–23.

Fifth Semester

CSci 157: Machine and Assembly Language Programming (3)
CSci 158: Algorithmic Methods and High Level Languages (3)
EE 12: Linear Networks II (3)
EE 20: Introductory Engineering Electronics (3)
EE 31: Fields and Waves I (3)
EE 63: Instrumentation and Networks Laboratory (1)
EE 65: Introductory Electronics Laboratory (1)

Sixth Semester

CSci 153: Design of Switching Systems (3)
CSci 159: Programming and Data Structures (3)
EE 32: Fields and Waves II (3)
EE 66: Digital Electronics Design Laboratory (1)
EE 67: Switching Circuits Laboratory (1)
EE 122: Pulse and Waveshaping Electronic Design (3)
Elective: Selected from humanities or social sciences (3)

Seventh Semester

CSci 150: Introduction to Microcomputers (3)
CSci 151: Introduction to Systems Programming I (3)
CSci 155: Introduction to Numerical Methods for Computers (3)
CSci 163: Senior Computer Science Project Laboratory (1)
CSci 166: Computer Science Laboratory I (1)
Elective: Technical elective (3) (one course selected from CSci 177, EE 113, 121, 133, 143 and one course selected from humanities or social sciences [3])

Eighth Semester

CSci 154: Digital Computer Design (3)
CSci 156: Introduction to Systems Programming II (3)
CSci 164: Senior Computer Science Project Laboratory (1)
CSci 167: Computer Science Laboratory II (1)
EE 172: Control Systems Design (3)
Elective: Technical elective (3) (one course selected from CSci 178, EE 124, 144, 165, 184)

Technical Electives

CSci 177: Programming for Management Systems (3)
CSci 178: Introduction to Database Management (3)
EE 113: Network Analysis and Design (3)
EE 121: Engineering Electronics and Design (3)
EE 124: Electronic Devices (3)
EE 133: Electromagnetic Waves and Microwave Systems Design (3)
EE 143: Elements of Communication Engineering Design I (3)
EE 144: Elements of Communication Engineering Design II (3)
EE 165: Senior Design Project (2)
EE 184: Medical Engineering Instrumentation and Systems Design (3)

Premedical Engineering Option

The Premedical Engineering option will permit the student who completes the work to obtain a bachelor's degree in engineering and have sufficient preparation to apply to a medical school for work toward a doctor of medicine degree. The student will also have sufficient background to work in various allied health fields, in the research and development of new electronic equipment used in medicine, or to continue as a graduate student in engineering with exceptional qualifications for medical engineering.

Prerequisite: first four semesters as described in the Core Curriculum, see pages 122–23.

Fifth Semester

Chem 151:	Organic Chemistry (3)
Chem 153:	Organic Chemistry Laboratory (1)
EE 12:	Linear Networks II (3)
EE 20:	Introductory Engineering Electronics (3)
EE 31:	Fields and Waves I (3)
EE 63:	Instrumentation and Networks Laboratory (1)
EE 65:	Introductory Electronics Laboratory (1)
EE 157:	Machine and Assembly Language Programming (3)

Sixth Semester

Chem 152:	Organic Chemistry (3)
Chem 154:	Organic Chemistry Laboratory (1)
CSci 153:	Design of Switching Systems (3)
EE 32:	Fields and Waves II (3)
EE 66:	Digital Electronics Design Laboratory (1)
EE 67:	Switching Circuits Laboratory (1)
EE 122:	Pulse and Waveshaping Electronic Design (3)
Elective:	Selected from humanities or social sciences (3)

Seventh Semester

EE 121:	Engineering Electronics and Design (3)
EE 143:	Elements of Communication Engineering Design I (3)
EE 163:	Senior Electrical Engineering Project Laboratory I (1)
EE 169:	Advanced Electronics Design Laboratory (1)
Elective:	Selected from humanities or social sciences (6)
Elective:	Technical elective (3)

Eighth Semester

EE 164:	Senior Electrical Engineering Project Laboratory II (1)
EE 172:	Control Systems Design (3)
EE 184:	Medical Engineering and Systems Design (3)
EE 186:	Medical Engineering Laboratory (1)
Elective:	Selected from humanities or social sciences (6)
Elective:	Technical elective (3)

Technical Electives

Bioc 221–22:	General Biochemistry (3–4)
BiSc 145:	Introduction to Vertebrate Embryology (4)
BiSc 148:	Histology (4)
EE 144:	Elements of Communication Engineering Design II (3)

Electrical Engineering Undergraduate Courses*

11 Linear Networks I (3)

Signals and waveforms, average value and RMS, network concepts, elements, and parameters. Kirchhoff's laws, simple networks, energy and power, differential equations of networks and their solution, phasors and steady-state analysis, measurements, impedance concepts, resonance, and filtering. Prerequisite: Phys 15, ApSc 113. (Spring—day and evening; fall—evening) (Zaghloul)

12 Linear Networks II (3)

Singular functions; Laplace transform; network functions, poles and zeros; total response; time and frequency domains; convolution theorems; Fourier analysis, spectra; frequency response. Bode plots; two-port parameters. Prerequisite: ApSc 114, EE 11. (Fall—day and evening; spring—evening) (Zaghloul)

20 Introductory Engineering Electronics (3)

Various types of devices used in electronic engineering considered from the point of view of the physics of their operation and from the engineering point of view of their application to electronic circuits. Solid-state, vacuum, and gaseous devices. Primary emphasis on application of these elements in power supplies and in linear amplifiers. Introduction of design concepts through use of graphical techniques. Prerequisite: EE 11. (Fall—day and evening; spring—evening) (Heller)

31 Fields and Waves I (3)

Vector calculus, orthogonal coordinates, Coulomb's and Gauss' laws, scalar potential, dipoles, method of images, dielectrics, capacitance, steady currents, Laplace's and Poisson's equations, boundary-value problems. Prerequisite: Phys 15, 16; ApSc 114. (Fall—day; fall, even years—evening) (Kahn)

32 Fields and Waves II (3)

Biot-Savart law, Ampere's law, vector potential, magnets, Faraday's law, Maxwell's equations, plane waves, and Poynting vector. Prerequisite: EE 31. (Spring—day; spring, odd years—evening) (Kahn)

51 Applications of Computers (3) (Same as CSci 51)

Introduction to the solution of problems on a digital computer using the FORTRAN or BASIC languages†; data processing concepts and numerical methods using batch or interactive time-shared terminal computer systems; writing, debugging, and running programs on various digital computer systems. Graduate students needing an introductory course in computers should enroll in EE/CSci 100. (Fall and spring—day and evening) (Feldman)

52 Computers and Societal Problems (3) (Same as CSci 52)

Application of the digital computer to the analysis and synthesis of physical, social, cultural, economic, and environmental processes and systems. Software methods for simulation, graphic display, data reduction, and file generation and access in time-shared and batch environments using FORTRAN or BASIC. Computer-related societal problems and processes. Group projects emphasizing research and investigative techniques applied to student-selected interests. Prerequisite: CSci or EE 51 or equivalent; two years of college preparatory mathematics. (Fall and spring—day and evening) (Bock)

*The faculty member whose name appears at the end of each course description is the director for the course. The course director is not necessarily the instructor for any given semester.

†Specific sections of this course will emphasize one or the other language; check *Schedule of Classes* at the beginning of each semester. EE and CS majors must select a BASIC section.

63 **Instrumentation and Networks Laboratory** (1)
Use of standard laboratory electronic instruments in the measurement of electrical and electronic components and networks. Verification of network laws and theorems. Characteristics and limitations of instruments. Application of instruments to measure voltage, current, resistance, impedance, power, time, period, and frequency. Use of digital multimeter, frequency counter, function generator, and oscilloscope to measure steady-state and transient phenomena. Prerequisite or concurrent registration: EE 12, EE 20, and EE 31. (Fall—day and evening; Spring—evening) (Rohlfs)

65 **Solid-State Devices Laboratory** (1)
Testing and measurement of the characteristics of solid-state devices used in electronic systems: diodes, BJTs, FETs, SCRs, Timers, Op Amps, and ICs. Applications of the devices. Design and measurement of the characteristics of power supplies, BJT and FET amplifier circuits, clipping and clamping circuits, power control circuits, and timing circuits. Prerequisite or concurrent registration: EE 12, EE 20, EE 31, and EE 63. (Fall—day and evening; Spring—evening) (Rohlfs)

66 **Digital Electronics Design Laboratory** (1)
Characteristics of electronic devices used in switching, sweeping and waveforming circuits. Generation of waveforms. Digital storage devices and sequential circuits. Characteristics of different methods to produce binary logic gates. Characteristics of integrated circuits. Prerequisite: EE 65. Prerequisite or concurrent registration: EE 122. (Spring—day and evening; fall—evening) (Rohlfs)

67 **Switching Circuits Laboratory** (1)
Analysis and design of combinational and sequential switching circuits using integrated circuits. Design of decoders, adders, counters, shift registers, character generators, and arithmetic circuits. Prerequisite or concurrent registration: EE 66 and 153. (Spring—day and evening; fall—evening) (Rohlfs)

100 **Introduction to Computer Science** (3) (Same as CSci 100)
A more intensive introductory course for students with a science, mathematics, or other quantitative background. Solution of problems on a digital computer using FORTRAN or BASIC language; data processing concepts, numerical and non-numerical methods using batch or interactive time-shared terminal computer systems. Writing, debugging, and running programs on various digital computer systems. Recommended for graduate and advanced undergraduate students in other departments. Prerequisite: Math 32 or equivalent. (Fall and spring—evening) (Feldman)

113 **Network Analysis and Design** (3)
Applications of matrix theory and linear graphs to electrical network analysis; network equations; signal-flow graphs; introduction to state-space techniques; solution of state-space equations on a digital computer. Network transfer functions, properties of active networks including reciprocity, stability, activity, and feedback. Use of network analysis programs such as ECAP. Prerequisite: EE 12, 20. (Fall—day; fall, even years—evening) (Lee)

116 **Introduction to Network Synthesis** (3)
Network functions and their properties. Positive-real functions and testing for this property. Two-element, one-port network synthesis; RLC one-port synthesis; the approximation problem in the frequency domain; modern filter theory and design; two-port ladder and lattice synthesis. Introduc-

tion to digital filters; truncation errors; realization techniques. Prerequisite: EE 113. (Spring—day; spring, odd years—evening) (Lee)

121 **Engineering Electronics and Design** (3)
Graphical analysis and design beyond the level covered in EE 20. Design of push-pull, direct-coupled and class B and C amplifiers. Design of operational amplifiers and their use in filters and electronic systems. Design of oscillators, active filters, modulators and demodulators. Design of power supplies. Prerequisite: EE 12, 20. (Fall—day and evening) (Heller)

122 **Pulse, Digital, and Waveshaping Electronic Design** (3)
Introduction to and design of large signal circuits used in computers and communications systems. Design of logic gates and flipflops. Concepts in integrated circuit design. Design of counting and timing circuits using IC's. Pulse, sweep and waveshaping circuits. Prerequisite: EE 12, 20. (Spring—day and evening) (Abd-Alla)

124 **Electronic Devices** (3)
Principles of operation of electronic devices used in electrical networks, communication systems, and electronic circuits. Properties of electronic devices and their applications. Modeling of devices such as diodes, transistors, and lasers. Fabrication methods of discrete components and integrated circuits. Prerequisite: EE 12, 32, 121, Phys 16. (Spring—day; spring, odd years—evening) (Heller)

133 **Electromagnetic Waves and Microwave Systems Design** (3)
Time-harmonic Maxwell equations, complex Poynting vector, transmission lines, characteristics of common waveguides, resonant cavities, Smith chart, design of coaxial and waveguide systems, Lorentz reciprocity, simple antennas, design of linear antenna arrays. Prerequisite: EE 32. (Fall—day; fall, even years—evening) (Kahn)

143 **Elements of Communication Engineering Design I** (3)
Signal analysis; Fourier transforms, power spectrum; principles of modulation, amplitude, frequency, and pulse modulation. Comparison of analog and digital transmission. Time and frequency division multiplexing. Random signals and noise. Transmission systems for cable, radio, satellite, and optical links. Prerequisite: EE 121, or concurrent registration; ApSc 114 or permission of course director. (Fall—day and evening) (Helgert)

144 **Elements of Communication Engineering Design II** (3)
Statistical theory of communication. Comparison of communication systems in noisy channels. Data communications, design of modems. Concept of information theory. Coding for noisy channels. ARQ and forward error control. Communication protocols. Elements of traffic theory. Special topics and student project. Prerequisite: EE 143 or permission of course director. May be taken for graduate credit by graduate students who are not majoring in communications. (Spring—day and evening) (Helgert)

146 **Communications Laboratory** (1)
Empirical study of several major topics in modern communications. Experiments are chosen from the areas of linear filters, random and pseudorandom processes, analog and digital communications, A/D conversion, source and channel coding, noise measurements, data security, and data networks. Prerequisite or concurrent registration: EE 12, 32, 63, 65, 121, 122, 143, 144, 153. (Spring—day and evening) (Helgert)

150 **Introduction to Microcomputers** (3) (Same as CSci 150)
Introduction to the structure of microprocessors and microcomputers. Representation of information in the computer. Logic and storage devices. Processor structure, registers, transfer of information and control.

Programming in microcomputers. I/O structure and auxiliary electronics. Interrupt structures, direct memory access. LSI and its implication for microcomputers. Arithmetic operations. Different microcomputer architectures. Prerequisite: CSci 153 or permission of course director. (Fall—day and evening) (Friedman)

151 **Introduction to Systems Programming I** (3) (Same as CSci 151)
Concepts and use of macro-assemblers and conditional assembly. Control of I/O via access methods. Job control languages and file structures. File and storage management. Use of linkers and loaders to create load modules. Prerequisite: EE 157 and 159. (Fall—day; fall, odd years—evening) (Feldman)

153 **Design of Switching Systems** (3) (Same as CSci 153)
Introduction to switching logic and combinational circuits. Analysis of switching devices. Minimization techniques. Number systems and codes, encoders and decoders, logic and electronic design of functional digital units. Use of LSI in logic design. Introduction to sequential circuits. Minimization of sequential machines. Design of synchronous, asynchronous and pulse sequential circuits. State-assignment and covers. May be taken for graduate credit by graduate students who are not majoring in computer science or computer heuristics, modeling, and numerical methods. (Spring—day and evening; fall—evening) (Friedman)

154 **Digital Computer Design** (3) (Same as CSci 154)
Logic and electronic design of functional digital units. Design of digital computer subsystems, flow of information and logical flow diagrams in timing and control signals. Design of binary and decimal, serial and parallel digital arithmetic units. Design of memory subsystems, channels, I/O, and storage subsystems. Design of the control unit of a digital computer. Introduction to microprogramming. Design of a small digital computer. Prerequisite: CSci or EE 153 or permission of course director. May be taken for graduate credit. (Spring—day and evening; fall—evening) (Abd-Alla)

155 **Introduction to Numerical Methods for Computers** (3) (Same as CSci 155)
Use of numerical methods in engineering and scientific problems. Concepts of algorithm and flowchart, errors in computer and numerical methods. Introduction to numerical methods for the solution of simultaneous linear algebraic equations, roots of equations, determination of eigenvalues and eigenvectors, numerical differentiation and integration, interpolation and solution of ordinary and partial differential equations. Statistical methods for the evaluation of experimental data and correlation techniques, curve fitting. Prerequisite: ApSc 114, 115; CSci/EE 51; or equivalent. (Fall—day; fall, even years—evening) (Meltzer)

156 **Introduction to Systems Programming II** (3) (Same as CSci 156)
Concepts of an operating system, monitors, dispatchers, initiators and control programs. Control of task, job stream and secondary storage. Memory management, interrupt handling, device management and scheduling algorithms. Concurrent processes. Performance evaluation in a multi-programmed environment. Prerequisite: CSci 151. (Spring—day; spring, even years—evening) (Hoffman)

157 **Machine and Assembly Language Programming** (3) (Same as CSci 157)
Programming of microcomputers, minicomputers, and large-scale computers in machine and assembly language. Number systems and codes. Architecture of various digital computers. Methods of addressing and machine control for fixed- and variable-word-length computers. Pro-

gramming on a stack architecture computer. Input-output control. Timing and benchmarking techniques. Prerequisite: CSci/EE 51 or equivalent. May be taken for graduate credit by graduate students who are not majoring in computer science or computer heuristics, modeling, and numerical methods. (Fall—day and evening; spring—evening) (Bock)

158 **Algorithmic Methods and High-Level Languages** (3) (Same as CSci 158)
Structure, application, and comparison of high-level programming languages. List structures. Recursive procedures. Structured programming. Top-down program design. Team-programming techniques. Meta-syntactical techniques. Introduction to parsing and compiling. String processing. Turing and Markov algorithms. Performance evaluation and benchmarking techniques. Prerequisite: CSci/EE 51. May be taken for graduate credit. (Fall—day and evening; spring—evening) (Bock)

159 **Programming and Data Structures** (3) (Same as CSci 159)
Discrete structures and data structures in computing. Use of tree structures, arrays, lists, stacks, files, strings and linked structures. Sorting, searching, hashing and merging of data files. List and string processing languages. Prerequisite: CSci 157, 158. May be taken for graduate credit. (Spring—day and evening) (Feldman)

160 **Electrical Measurements and Instrumentation** (3)
Electrical measurement from direct current through high radio frequencies. Measurements of current, voltage, power, resistance, capacitance, inductance, energy, phase angle, frequency, and time. Measurements of high-frequency signals including field strength, signal-to-noise ratio, impedance, and attenuation. Analog-to-digital conversion techniques and digital instrumentation for the control of measurement and instrumentation systems. Transducer characteristics and analog signal processing instrumentation. Laboratory demonstrations of measurements and instrumentation techniques. Prerequisite: EE 12, 32, 121, 150. (Spring—evening) (Heller)

163 **Senior Electrical Engineering Project Laboratory I** (1)
The student will conceive and design a one-year project which will be completed in EE 164. As part of the project the student must perform a market survey and economic analysis of the product. The student will complete the preliminary design in this semester. Prerequisite: EE 67. Prerequisite or concurrent registration: EE 121, 143, and senior status. (Fall—day and evening) (Meltzer)

164 **Senior Electrical Engineering Laboratory II** (1)
The student will complete and construct the project which was started in EE 163. The student will make both an oral and written presentation of the product designed. Prerequisite: EE 163. (Spring—day and evening) (Meltzer)

165 **Senior Design Project** (2)
The student will conceive, design, construct, and test an original project in hardware or software. A complete report will be written including, if applicable, schematic diagrams and repair procedures. Prerequisite: senior status. (Spring—day) (Pickholtz)

166 **Power Systems Laboratory I** (1)
Experiments in support of the analysis and design of electrical power systems. Measurements of the characteristics of newer devices to generate electricity. Fault analysis on electrical machines. Prerequisite or concurrent registration: EE 32, 177, 178. (Fall—day and evening) (Harrington)

168 **Microwave and Laser Engineering Laboratory** (1)
Experiments in support of analysis and design of transmission lines, microwave components, microwave systems, fiber-optic systems, antennas and

antenna arrays. Introduction to the characteristics of laser and optical systems. Prerequisite: EE 32, 67. Prerequisite or concurrent registration: EE 133, 143. (Fall—day and evening) (Kahn)

169 Advanced Electronics Design Laboratory (1)
Experiments in support of the theory of the analog operation of electronic devices. Characteristics of nonlinear operation of electronic devices. Use of electronic devices in communication equipment. May be taken for graduate credit by graduate students who are not majoring in Energy Conversion, Power, and Transmission. Prerequisite: EE 32, 67. Prerequisite or concurrent registration: EE 121, 143. (Fall—day and evening) (Heller)

172 Control Systems Design (3)
Mathematical models of linear systems; steady-state and transient analyses; root locus and frequency response methods; synthesis of linear feedback control systems. Prerequisite: ApSc 114; and EE 12 or ME 134. (Spring—day and evening) (Carroll)

***176 Control Systems Laboratory (1)**
Experiments in support of control theory. Characteristics of control components. Control components in feedback systems. Effects of nonlinearity on control systems. Prerequisite or concurrent registration: EE 12, 20, 63, 65, 113, 172. (Spring—day and evening) (Carroll)

177 Electrical Energy Conversion (3)
Fundamentals of electromechanical energy conversion. Electromechanical transducers and their equivalent circuits, three-phase and single-phase a-c rotating machines, d-c machines, rotating machines as circuit elements. Prerequisite: EE 12, 31. (Spring—day; spring, even years—evening) (Harrington)

178 Electrical Power Systems (3)
Introduction to electrical power systems; transmission and distribution of electrical power, three-phase circuits, symmetrical components, fault analysis by digital computer. Load-flow studies, economic considerations. Power station designs and synchronization of generators. Methods of generating electrical power. Prerequisite: EE 177, senior status. (Fall—evening) (Harrington)

179 Electrical Machine Control (3)
Torque and speed control requirements. Controlled rectifier characteristics. Dc and ac machine characteristics. Bridge rectifier and inverter. Inverter control of three-phase ac motor. Industrial applications. May be taken for graduate credit by graduate students who are not majoring in Energy Conversion, Power, and Transmission. Prerequisite: EE 1[illegible] (Spring—day) (Harrington)

184 Medical Engineering Instrumentation and Systems Design (3)
Designed to introduce the engineering or physical sciences student to the applications of engineering design in the medical sciences; terminology of the medical profession emphasized; the physiology of the human body presented from overall systems or functional approach; survey of present-day medical measurements and consideration of those areas in which engineering design may be applied advantageously to medicine. May be taken for graduate credit except by medical engineering majors. (Spring—evening) (Eisenberg)

186 Medical Engineering Laboratory (1)
Experiments in support of instrumentation used in medicine and biology; safety considerations. Acquisition and measurement of physiological signals, EKG, EEG, evoked potentials. Processing of signals derived from

* Effective Fall Semester 1982.

physiological measurements. Concepts in telemetry of medical signals. Prerequisite or concurrent registration: EE 12, 32, 66, 121, 184. (Spring—day and evening) (Loew)

198 **Research** (including Honors Research Seminar) (1 to 3)
Applied research and experimentation projects, as arranged. Prerequisite: junior or senior status. (Fall and spring)

Computer Science Undergraduate Courses

30 **Introduction to Computing** (3)
An introductory course for students whose majors are not electrical engineering or computer science. Survey of computers and languages; communicating with a computer; introduction to the BASIC language; obtaining output from a computer; history of computing; positions in the computing industry; the effect of computers on our lives; uses for computers. Prerequisite: Algebra. (Fall—day) (Hoffman)

51 **Applications of Computers** (3) (Same as EE 51)
Introduction to the solution of problems on a digital computer using FORTRAN or BASIC languages*; data processing concepts and numerical methods using batch or interactive time-shared terminal computer systems; writing, debugging, and running programs on various digital computer systems. Graduate students seeking a first course in computing should enroll in EE/CSci 100. (Fall and spring—day and evening) (Feldman)

52 **Computers and Societal Problems** (3) (Same as EE 52)
Application of the digital computer to the analysis and synthesis of physical, social, cultural, economic, and environmental processes and systems. Software methods for simulation, graphic display, data reduction, and file generation and access in time-shared and batch environments using FORTAN or BASIC. Computer-related societal problems and processes. Group projects emphasizing research and investigative techniques applied to student-selected interests. Prerequisite: CSci/EE 51 or equivalent; two years of college preparatory mathematics. (Fall and spring—day and evening) (Bock)

100 **Introduction to Computer Science** (3) (Same as EE 100)
A more intensive introductory course for students with a science, mathematics, or other quantitative background. Solution of problems on a digital computer using FORTRAN or BASIC language; data processing concepts, numerical and non-numerical methods using batch or interactive time-shared terminal computer systems. Writing, debugging, and running programs on various digital computer systems. Recommended for graduate and advanced undergraduate students in other departments. Prerequisite: Math 32 or equivalent. (Fall and spring—evening) (Feldman)

150 **Introduction to Microcomputers** (3) (Same as EE 150)
Introduction to the structure of microprocessors and microcomputers. Representation of information in the computer. Logic and storage devices. Processor structure, registers, transfer of information and control. Programming in microcomputers. I/O structure and auxiliary electronics. Interrupt structures, direct memory access. LSI and its implication for microcomputers. Arithmetic operations. Different microcomputer architectures. Prerequisite: CSci 153 or permission of course director. (Fall—day and evening) (Friedman)

*Sections of this course will emphasize one or the other language: check *Schedule of Classes* beginning of each semester. EE and CS majors must select a BASIC section.

151 **Introduction to Systems Programming I** (3) (Same as EE 151)
Concepts and use of marco-assemblers and conditional assembly. Control of I/O via access methods, Job control languages and files structures. File and storage management. Use of linkers and loaders to create load modules. Prerequisite: CSci 157, 159. (Fall—day; fall, odd years—evening) (Feldman)

153 **Design of Switching Systems** (3) (Same as EE 153)
Introduction to switching logic and combinational circuits. Analysis of switching devices. Minimization techniques. Number systems and codes, encoders and decoders, logic and electronic design of functional digital units. Use of LSI in logic design. Introduction to sequential circuits. Minimization of sequential machines. Design of synchronous, asynchronous and pulse sequential circuits. State-assignment and covers. May be taken for graduate credit except by majors in computer science or computer heuristics, modeling, and numerical methods. (Spring—day and evening; fall—evening) (Friedman)

154 **Digital Computer Design** (3) (Same as EE 154)
Logic and electronic design of functional digital units. Design of digital computer subsystems, flow of information and logical flow diagrams in timing and control signals. Design of binary and decimal, serial and parallel digital arithmetic units. Design of memory subsystems, channels, I/O, and storage subsystems. Design of the control unit of a digital computer. Introduction to microprogramming. Design of a small digital computer. Prerequisite: CSci 153 or permission of course director. May be taken for graduate credit. (Spring—day and evening; fall—evening) (Abd-Alla)

155 **Introduction to Numerical Methods for Computers** (3) (Same as EE 155)
Use of numerical methods in engineering and scientific problems. Concepts of algorithm and flowchart, errors in computer and numerical methods. Introduction to numerical methods for the solution of simultaneous linear algebraic equations, roots of equations, determination of eigenvalues and eigenvectors, numerical differentiation and integration, interpolation and solution of ordinary and partial differential equations. Statistical methods for the evaluation of experimental data and correlation techniques, curve fitting. Prerequisite: ApSc 114, 115; CSci or EE 51; or equivalent. (Fall—day; fall, even years—evening) (Meltzer)

156 **Introduction to Systems Programming II** (3) (Same as EE 156)
Concepts of an operating system, monitors, dispatchers, initiators and control programs. Control of task, job stream and secondary storage. Memory management, interrupt handling, device management and scheduling algorithms. Concurrent processes. Performance evaluation in a multi-programmed environment. Prerequisite: CSci 151. (Spring—day, spring, even years—evening) (Hoffman)

157 **Machine and Assembly Language Programming** (3) (Same as EE 157)
Programming of microcomputers, minicomputers, and large-scale computers in machine and assembly language. Number systems and codes. Architecture of various digital computers. Methods of addressing and machine control for fixed- and variable-word-length computers. Programming on a stack architecture computer. Input-output control. Timing and benchmarking techniques. Prerequisite: CSci EE 51 or equivalent. May be taken for graduate credit by graduate students who are not majoring in computer science or computer heuristics, modeling, and numerical methods. (Fall—day and evening; spring—evening) (Bock)

158 **Algorithmic Methods and High-Level Languages** (3) (Same as EE 158)

Structure, application, and comparison of high-level programming languages. List structures. Recursive procedures. Structured programming. Top-down program design. Team-programming techniques. Meta-syntactical techniques. Introduction to parsing and compiling. String processing. Turing and Markov algorithms. Performance evaluation and benchmarking techniques. Prerequisite: CSci/EE 51. May be taken for graduate credit. (Fall—day and evening; spring—evening) (Bock)

159 **Programming and Data Structures** (3) (Same as EE 159)

Discrete structures and data structures in computing. Use of tree structures, arrays, lists, stacks, files, strings and linked structures. Sorting, searching, hashing and merging of data files. List and string processing languages. Prerequisite: CSci/EE 157, 158. May be taken for graduate credit. (Spring—day and evening) (Feldman)

163 **Senior Computer Science Project Laboratory I** (1)

The student will conceive and design a one-year project in hardware and/or software which will be completed in CSci 164. As part of the project the student must perform a market survey and economic analysis of the product. The student will complete the preliminary design in this semester. Prerequisite or concurrent registration: EE 63, 65, 122, 153, 157, 158, 159 and senior status. (Fall—day and evening) (Abd-Alla)

164 **Senior Computer Science Project Laboratory II** (1)

The student will complete and construct the project which was started in CSci 163. The student will make both an oral and written presentation of the product designed. Prerequisite: CSci 163. (Spring—day and evening) (Abd-Alla)

166 **Computer Science Laboratory I** (1)

Experiments in support of the theory and design of micro-processor and microcomputer hardware and software. Use of microprocessors in control of systems. Use of simulators, cross-compilers and development systems. Prerequisite or concurrent registration: EE 63, 65, 66, 67, 122; CSci 150, 153, 157. (Fall—day and evening) (Abd-Alla)

167 **Computer Science Laboratory II** (1)

Experiments in support of the design of digital computing systems. Design of memory, control and arithmetic units. Input and output in a computer. Software experiments to support the operating system for a small computer. Prerequisite or concurrent registration: CSci 151, 154, 156, 157, 158, 159, 166; EE 66, 67. (Spring—day and evening) (Abd-Alla)

177 **Programming for Management Systems** (3)

An intermediate programming course with application in business and government commercial programming. Emphasis on programming for accounting and management information systems. Use of files editing, report generation, and tapes. The COBOL language will be utilized. Prerequisite: CSci 158. (Fall—evening) (Bock)

178 **Introduction to Database Management** (3)

Concepts in database systems; inverted file structure; query formulation and language; data structure to minimize access time; construction of a database management system; survey of some existing database management systems. Prerequisite: CSci 158 and 159. (Spring—evening) (Berkovich)

198 **Research** (including Honors Research Seminar) (1 to 3)

Applied research and experimentation projects, as arranged. Prerequisite: junior or senior status. (Fall and spring)

GRADUATE STUDY

The Department of Electrical Engineering and Computer Science provides the student who possesses a degree of maturity and basic knowledge one of the most stimulating experiences for advanced study. The Department offers study leading to the Master of Science, Professional, and Doctor of Science degrees. The student may study in an area of concentration such as Systems Science, Networks, and Controls; Electrophysics (electronics, fields, and waves); Communications; Medical Engineering; Computer Science (hardware, software, and systems); Simulation and Numerical Methods; Energy Conversion, Power, and Transmission; or Telecommunications and Computers.

The graduate programs are formulated to take into consideration the student's individual strengths, skills, aspirations, and abilities and are determined through consultation by the student with the faculty adviser. The program should provide the student with a thorough understanding of the area of concentration and with a breadth of knowledge necessary in modern engineering and computer science. Each graduate student is assigned a faculty adviser on the basis of study interests, helping to develop a close student-faculty relationship during the course of the program.

Colloquium Requirement: Graduate students are required to attend several Department colloquia each semester. These are intended to broaden the student's professional outlook and to encourage interaction with the faculty. Schedules are posted.

The graduate programs are also designed to provide an educational service to the Washington technical community. Many courses have been developed after consultation with private industry and government agencies in the area. A substantial number are offered both during the afternoon and evening and alternate from year to year.

The Department of Electrical Engineering and Computer Science has continuously kept the graduate program up to date through contact with recent developments, research generated within the Department, and the addition of experts in appropriate fields who serve as part-time and adjunct faculty.

The Department of Electrical Engineering and Computer Science periodically publishes a detailed brochure to supplement the present catalogue with information about procedures, requirements, regulations, and scope of its graduate programs. Special pamphlets describing specific programs are also available.

Areas of Concentration

COMMUNICATIONS

EE 204: Stochastic Signals and Noise
EE 205: Stochastic Processes in Electrical Engineering
EE 208: Digital Image Processing
EE 241: Information Theory
EE 242: Coding Theory
EE 243: Communication Theory I
EE 244: Communication Theory II
EE 245: Signal Detection and Estimation Theory
EE 246: Digital Communications
*EE 247: Communication Systems

* Doctoral students must select a minimum of three courses designated with an asterisk as part of their program in their major area.

EE 248: Data Communication Systems
EE 249: Theory of Data- and Computer-Communication Networks
EE 252: Digital Signal Processing Techniques
EE 253: Sonar Systems
EE 254: Radar Systems
EE 257: Secure Communications
*EE 258: Radio Communication Systems I
*EE 259: Radio Communication Systems II
*EE 277: Satellite Communication Systems
EE 298: Research
EE 299–300: Thesis Research
*EE 345: Advanced Detection Theory
*EE 346: Communications Switching and Traffic Theory
EE 347: Data Communications
EE 349: Communications Research
EE 399: Dissertation Research

MULATION AND NUMERICAL METHODS

EE 202: Linear System Theory
EE 203: Graph Theory and Applications
EE 252: Digital Signal Processing
EE 272: Discrete Systems
EE 276: Cybernetics
*EE 371: Simulation Methods for Systems Analysis
CSci 159: Programming and Data Structures
CSci 201: Introduction to Computer Systems I
*CSci 220: Pattern Recognition
CSci 221: Simulation and Heuristics
*CSci 223: Computational Heuristics
*CSci 224: Artificial Intelligence
*CSci 226: Robotics
*CSci 278: Analog and Hybrid Computers
CSci 281: Applications of Numerical Methods I
CSci 282: Applications of Numerical Methods II
*CSci 286: Numerical Methods in Engineering I
*CSci 287: Numerical Methods in Engineering II
*CSci 288: Numerical Methods in Engineering III
*CSci 289: Numerical Methods in Engineering IV
CSci 298: Research
i 299–300: Thesis Research
CSci 399: Dissertation Research

PUTER SCIENCE (HARDWARE, SOFTWARE, AND SYSTEMS)

CSci 154: Digital Computer Design
CSci 158: Algorithmic Methods and High-Level Languages
CSci 159: Programming and Data Structures
CSci 201: Introduction to Computer Systems
CSci 203: Microprocessors and Microcomputers
CSci 208: Computer Programming
CSci 213: Discrete Structures in Computing
CSci 215: Advanced Data Structures
CSci 216: Information Retrieval Systems

al students must select a minimum of three courses designated with an asterisk as part of their in their major area.

CSci 219: Interactive Computer Graphics I
CSci 222: Design of User-Computer Dialogues
CSci 227: Management Information Systems and Data Base Management
CSci 229: Security and Privacy in Computer Systems
CSci 231: Sequential Machines
CSci 232: Automata and Formal Languages
CSci 237: Computing Systems
*CSci 239: Comparative Computer Systems
*CSci 240: Theory and Practice of Microprogramming
CSci 243: Fault Tolerant Systems and Design Automation
CSci 244: Data Communications
*CSci 245: Advanced Computer Systems Theory I
*CSci 246: Advanced Computer Systems Theory II
*CSci 255: Analysis and Correctness of Algorithms
*CSci 256: Design of Translators
*CSci 258: Advanced Programming Languages
CSci 263: Digital Computer Programming Systems
*CSci 267: Operating Systems I
*CSci 268: Operating Systems II
CSci 298: Research
CSci 299–300: Thesis Research
*CSci 319: Interactive Computer Graphics II
CSci 391: Computer Science Research
CSci 399: Dissertation Research

ELECTROPHYSICS (ELECTRONICS, FIELDS, AND WAVES)

EE 201: Natural Modes and Transients in Electrical Systems
EE 206: Electromagnetic Theory and Applications I
EE 207: Electromagnetic Theory and Applications II
EE 221: Physical Electronics I
EE 222: Physical Electronics II
EE 223: Optical Communications Systems
*EE 224: Electronics of Lasers
EE 225: Nonlinear Electronics
*EE 226: Fiber and Integrated Optics
EE 227: Industrial Electronics
EE 228: High-frequency Electronics
EE 231: Field Analysis and Potential Theory
*EE 232: Electrodynamics
EE 233: Microwaves and Components
*EE 234: Electromagnetic Wave Propagation
EE 235: Antennas
*EE 236: Plasma Dynamics
*EE 237: Waves in Random Media
EE 238: Remote Sensing
EE 239: Numerical Laboratory in Electromagnetics
EE 255: Optical Processing
EE 298: Research
EE 299–300: Thesis Research
*EE 321: Approximate Mathematical Techniques for Electromagnetics
*EE 322: Advanced Waveguide Diffraction and Design
*EE 323: Principles of Microelectronics

* Doctoral students must select a minimum of three courses designated with an asterisk as part of their program in their major area.

*EE 329: Electrophysics Research
EE 399: Dissertation Research

ENERGY CONVERSION, POWER, AND TRANSMISSION

EE 201: Natural Modes and Transients in Electrical Systems
EE 202: Linear System Theory I
EE 206: Electromagnetic Theory and Applications I
EE 212: Advanced Network Analysis
*EE 261: Electromechanical Energy Conversion
*EE 262: Control of Rotating Machinery
EE 263: Design of Reliable Emergency and Standby Power Systems
*EE 264: Direct Electrical Energy Conversion
EE 265: Transients in Electrical Power Systems
EE 266: Electrical Power Transmission
EE 267: Power Networks
EE 268: Electrical Power Distribution
EE 269: Overall Electrical Power Generation Plant Design
EE 298: Research
EE 369: Issues in Electrical Power Systems
EE 399: Dissertation Research

EDICAL ENGINEERING

EE 280: Introduction to Medicine for Engineers I: Physiology and Anatomy
EE 281: Introduction to Medicine for Engineers II: Physiology and Anatomy
EE 282: Medical Instrumentation I
EE 283: Medical Instrumentation II
EE 285: Sensory-evoked Potentials I
EE 287: Engineering in Physical Medicine and Rehabilitation
*EE 289: Clinical Engineering
EE 298: Research
E 299–300: Thesis Research
*EE 380: Bioelectric Phenomena
*EE 381: Computer-aided Analysis of Physiological Signals
*EE 382: Physiological Controls and Systems
*EE 385: Sensory-evoked Potentials II
EE 389: Medical Engineering Research
EE 399: Dissertation Research

TEMS SCIENCE, NETWORKS, AND CONTROLS

EE 202: Linear Systems Theory
EE 203: Graph Theory
EE 204: Stochastic Signals and Noise
EE 212: Network Analysis
*EE 213: Computer-aided Analysis and Design of Systems
EE 215: Network Synthesis
*EE 216: Synthesis of Active and Distributed Networks
*EE 217: Advanced Network Theory
*CSci 220: Pattern Recognition
*EE 271: Linear Multivariable Control Theory
EE 272: Computer Control Systems

al students must select a minimum of three courses designated with an asterisk as part of their in their major area.

EE 273:	Systems Optimization
*EE 274:	Nonlinear Systems
*EE 275:	System Identification and Adaptive Control Systems
*EE 279:	Stochastic Control Theory
EE 298:	Research
EE 299–300:	Thesis Research
EE 319:	Systems Science, Networks, and Control Research
*EE 372:	Analysis and Control of Large Systems
EE 399:	Dissertation Research

TELECOMMUNICATIONS AND COMPUTERS

EE 144:	Elements of Communication Engineering Design II
EE 204:	Stochastic Signals and Noise
EE 205:	Stochastic Processes in Electrical Engineering
EE 242:	Coding Theory
EE 243:	Communication Theory I
EE 244:	Communication Theory II
EE 246:	Digital Communications
EE 248:	Data Communications Systems
EE 249:	Theory of Data- and Computer-Communication Networks
EE 257:	Secure Communications
EE 346:	Communication Switching and Traffic Theory
EE 348:	Data Communications
CSci 159:	Programming and Data Structures
CSci 201:	Introduction to Computer Systems
CSci 216:	Information Retrieval Systems
CSci 227:	Management Information Systems and Data Base Management
CSci 229:	Security and Privacy in Computer Systems
CSci 244:	Data Communications
CSci 263:	Digital Computer Programming Systems
CSci 267:	Operating Systems I
CSci 268:	Operating Systems II
EAd 211-12:	Engineering Administration
EAd 261:	Economic Analysis in Engineering Planning
EAd 262:	Finance for Engineers
EAd 269:	Elements of Decision-Making and Problem-Solving
EAd 281:	Systems Analysis and Management I
EAd 292:	Structural Analysis of Management Problems

MASTER OF SCIENCE DEGREE PROGRAM

The Department of Electrical Engineering and Computer Science offers graduate study leading to the degree of Master of Science in the following areas of concentration. Faculty members who may serve as advisers are listed after each area.

1. Communications (Braun, Chang, Helgert, Heller, Lang, Pickholtz)

2. Simulation and Numerical Methods (Abd-Alla, Bock, Feldman, Foley, Hoffman, Loew, Maurer, Meltzer, Zaghloul)

3. Computer Science (hardware, software, and systems) (Abd-Alla, Berkovich, Bock, Feldman, Foley, Friedman, Hoffman, Kyriakopoulos, Maurer, Meltzer, Merwin, Zaghloul)

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* Doctoral students must select a minimum of three courses designated with an asterisk as part of their program in their major area.

4. Electrophysics (electronics, fields, and waves) (Braun, Eisenberg, Heller, Kahn, Lang)

5. Energy Conversion, Power, and Transmission (Harrington, Kahn, Lang, Meltzer)

6. Medical Engineering (Eisenberg, Loew)

7. Systems Science, Networks, and Controls (Carroll, Kyriakopoulos, Lee, Meltzer, Zaghloul)

8. Telecommunications and Computers (Chang, Helgert, Hoffman, Meltzer, Rickholtz; Shane, Steiner [Engineering Administration])

There are no required courses or programs of study in any of the areas of concentration. Each student formulates an individualized program in consultation with the assigned faculty adviser.

Admission

In addition to the general requirements, the applicants must have satisfied admission to graduate study (see pages 28–29). Admission to graduate study toward a Master's degree requires an appropriate Bachelor's degree (one in engineering technology is normally not sufficient) from a recognized institution and evidence of capacity for productive work in the field selected, as indicated by grades, Graduate Record Aptitude Test scores, and similar data. Students are encouraged to submit Graduate Record Examination scores; candidates who do submit such scores will be given preference in consideration for research and teaching fellowships. The transfer of credit regulations (see page 25) apply as well to courses taken as a non-degree student through the Division of Continuing Education and Summer Sessions at George Washington University.

GENERAL REQUIREMENTS

1. The applicant must be recommended for admission by the Chairman of the Department of Electrical Engineering and Computer Science.

2. The applicant must have at least a quality-point index of 2.70 (on a 4.00 with 4.00 maximum), or equivalent, for the last 60 semester hours of undergraduate work.

3. The applicant must be adequately prepared in the basic sciences (physics, chemistry or biology) and in mathematics (four semesters beyond pre-calculus).

SPECIFIC REQUIREMENTS

In addition to the general requirements, the applicant must have satisfied through undergraduate studies the following specific requirements according to area of concentration:

Communications

Networks with applications using Laplace transforms (6 semester hours—EE 11 and 12; or equivalent)

Electronics (3 semester hours—EE 20; or equivalent)

Communication theory (3 semester hours—EE 143; or equivalent)

Simulation and Numerical Methods

1. Computer programming using FORTRAN (6 semester hours—CSci 51, 157; or equivalent)
2. Mathematics including partial differential equations, matrices, and eigenvalue problems
3. Probability and statistics (3 semester hours—ApSc 115; or equivalent)

Computer Science

1. Computer programming using FORTRAN (3 semester hours—EE 51; or equivalent)
2. Computer hardware and computer software (6 semester hours—CSci 153 and CSci 157; or equivalent)

Electrophysics

1. Networks with applications using Laplace transforms (6 semester hours—EE 11 and 12; or equivalent)
2. Electronics including analysis, design, and physical theory (6 semester hours—EE 20 and 121; or equivalent)
3. Fields and waves (6 semester hours—EE 31 and 32; or equivalent)

Energy Conversion, Power, and Transmission

1. Network analysis using Laplace transforms (6 semester hours—EE 11 and 12; or equivalent)
2. Fields and waves (6 semester hours—EE 31 and 32; or equivalent)
3. Electrical energy conversion (3 semester hours—EE 177; or equivalent)

Medical Engineering

Either:

1. Network theory (3 semester hours—EE 11; or equivalent)
2. Electronic circuits (6 semester hours—EE 20 and 121; or equivalent)

Or:

1. Computer programming (3 semester hours—CSci 51; or equivalent)
2. Computer hardware and software (6 semester hours—CSci 153 and 157; or equivalent)

Systems Science, Networks, and Controls

1. Networks with applications using Laplace transforms (9 semester hours—EE 11, 12, and 113; or equivalent)
2. Electronics (3 semester hours—EE 20; or equivalent)
3. Control theory (3 semester hours—EE 172; or equivalent)

Telecommunications and Computers

1. Communication theory (3 semester hours—EE 143; or equivalent)
2. Computer Science (6 semester hours—CSci 51 and either CSci 150 or CSci 157; or equivalent)

In cases where some undergraduate deficiencies exist, the student may be required to complete 6 semester hours of undergraduate work. Normally this work must be completed prior to enrolling in graduate courses. If such deficiencies represent more than 6 semester hours, the applicant may be ad-

mitted as an unclassified student to complete a specified undergraduate program before being admitted as a graduate student.

rogram of Study

pon admission to the Master of Science degree program, the graduate student is assigned a faculty adviser. In consultation, the student and faculty dviser formulate the program of study and complete the form "Graduate rogram of Studies" (Form 1) for submission to the Department Chairman or approval. This form should be completed prior to or at the student's first egistration. During consultation, the student should determine whether to equest permission to pursue the nonthesis option.

The program of study for the Master of Science degree consists of a minimum of 24 semester credit hours of graduate-level courses and 6 semester urs of thesis or, for the nonthesis option, a minimum of 33 credit hours of aduate-level courses. For the thesis option, a minimum of 12 semester credit urs must be in the major field of concentration, and no less than three aduate-level courses must be in areas other than the student's area of concentration (the major). For the nonthesis option, a minimum of 21 semester redit hours must be in the major field, and no less than three courses must e in areas other than the student's major area. In the case of an interdisciplinary program, no courses outside the major are required, but an approximately equal division of courses between or among the disciplines is required. A maximum of three courses at the 100 level may be counted toward the quirements for the degree; the course description must specify that the urse may be taken for graduate credit.

ster's Comprehensive Examination

fter completing the prescribed program in either the thesis or the nonthesis tion, the student must pass the Master's Comprehensive Examination. The amination is scheduled twice a year. On the prescribed form, and prior to deadline, students must notify the Department of their intent to take the amination. Thereafter, requests to withdraw must be submitted in writing in ance of the examination date. Unexcused absence constitutes a forfeiture is regarded as a failure of the examination. The examination lasts an en- day, and the student is asked to solve several problems relating to the sub- matter of his major area of study. The student must demonstrate the ability pply what has been learned while pursuing a formal graduate program. The amination is not limited to those specific courses which the student has tak- but is designed to demonstrate the student's ability to integrate material several course areas as well as to learn from the readings.

student who fails the Master's Comprehensive Examination on the first mpt may, in exceptional circumstances, be re-examined one more time if oval is given by the appropriate examining committee and the depart- nt. In the event of failure to pass the examination on the second attempt, tudent's candidacy and graduate status terminate.

FESSIONAL DEGREE PROGRAM

Department of Electrical Engineering and Computer Science offers grad- study leading to a Professional degree. This program is for students who

are interested in pursuing course work beyond the Master's degree with emphasis on applied subject material rather than on research. Successful completion of the Professional degree program leads to the degrees of Engineer or Applied Scientist. Students may study for the Professional degree in the following areas of concentration. Communications; Computer Science (hardware, software, and systems); Electrophysics (electronics, fields, and waves); Medical Engineering; Systems Science, Networks, and Controls; Energy Conversion, Power, and Transmission; and Simulation and Numerical Methods.

There are no formal required courses or programs of study in any of the areas of concentration for the Professional degree. Each student formulates an individualized program in consultation with the assigned faculty adviser.

Admission

In addition to the School of Engineering and Applied Science requirements for admission to graduate study toward a Professional degree (see pages 33–34), applicants for the Professional degree programs in the Department of Electrical Engineering and Computer Science must meet the following general and specific requirements.

GENERAL REQUIREMENTS

1. The applicant must be recommended for admission by the Chairman of the Department of Electrical Engineering and Computer Science.
2. The applicant must have a quality-point index of at least 3.0 (on a scale of 4.0 maximum), and two years of professional experience after obtaining the Master's degree.
3. The applicant must be adequately prepared in the basic sciences (physics, and chemistry or biology) and in mathematics (calculus through differential equations).

SPECIFIC REQUIREMENTS

In addition to the general requirements, the applicant must have satisfied through previous studies the following specific requirements according to the area of concentration:

Communications

Nine semester hours of statistical theory of communication and 3 semester hours of information theory—EE 204, 241, 243, and 244; or equivalent.

Simulation and Numerical Methods

Twelve semester hours of computer science and numerical methods at the graduate level—CSci 159, 201, 221, and 281; or equivalent.

Computer Science

Fifteen semester hours of computer system design and software beyond the use of a compiler language—CSci 153, 154, 159, 201, and 213; or equivalent.

Electrophysics

Twelve semester hours of physical electronics, and electromagnetics at the graduate level—EE 201, 206, 207, and 221; or equivalent.

Energy Conversion, Power, and Transmission

Twelve semester hours of electrical machine theory and networks at the graduate level—EE 261, 262, 264, and 266; or equivalent.

Medical Engineering

Twelve semester hours of medical engineering at the graduate level—EE 280, 281, 282 and 283; or equivalent.

Systems Science, Networks, and Controls

Twelve semester hours of network system analysis at the graduate level, including a knowledge of state space and linear graph theory—EE 202, 204, 212, 272, and 273; or equivalent.

An applicant who fails to meet the above specific requirements, but meets all other admission requirements, may be admitted with a program of study which is increased beyond the minimum requirements so that sufficient background material may be covered.

Program of Study

Upon admission to the Professional degree program, the student is assigned a faculty adviser. Together they will formulate a program of study for the student which must contain a minimum of 30 semester hours of courses, and complete the form "Graduate Program of Study." Programs of study and any subsequent changes must be approved by both the faculty adviser and the Department Chairman.

The program of study for the Professional degree in the Department of Electrical Engineering and Computer Science will normally consist of a minimum of 18 semester hours of graduate-level courses in the major area of concentration and a minimum of 9 additional semester hours of graduate-level courses outside the major area but in support of the student's program. A student who is changing the major area from that studied for the Master's degree or who is lacking the specific requirements needed for admission may be required to take additional courses to make up deficiencies. Such additional work should not normally exceed 12 semester hours.

DOCTOR OF SCIENCE PROGRAM

The Department of Electrical Engineering and Computer Science offers programs of graduate study leading to the degree of Doctor of Science in the areas of concentration listed below. There are no formal required courses or programs of study in the areas listed. Upon admission, each student formulates an individualized program in consultation with the assigned faculty adviser. Special fields of each faculty member are listed below.

ABD-ALLA, A.—Professor of Engineering and Applied Science.
Digital Computer Systems; Time-sharing Systems; Logical Design of Switching Circuits; Microprocessors.

BARANIECKI, A.—Visiting Assistant Professor of Engineering.
Digital Signal Processing; Digital Filtering.

BERKOVICH, S.—Associate Professor of Engineering and Applied Science.
Information Systems; Data Structures; Associative Memories and Processors.

BOCK, P.—Associate Professor of Engineering.
Computer Science; Simulation; Programming Languages; Microprocessor Systems; Artificial Intelligence; Robotics.

BRAUN, E.H.—Associate Professor of Engineering and Applied Science.
Antenna Theory; Coding Theory; Physical Electronics.

CARROLL, R.L.—Associate Professor of Engineering and Applied Science.
Control Theory; Adaptive Systems.

CHANG, S-C.—Assistant Professor of Engineering.
Error Correcting Codes; Logic Design; Communication Theory and Systems.

EISENBERG, M.F.—Professor of Engineering and Applied Science.
Medical Engineering; Thermography; Evoked Response; Ultrasonics.

FELDMAN, M.B.—Associate Professor of Engineering and Applied Science.
Computer Science, Programming Languages; Data Structures; Information Display Systems; Computer Graphics; Automata Theory.

FOLEY, J.D.—Associate Professor of Engineering and Applied Science.
Interactive Computer Graphics; System Modeling and Measurement; Human Factors of the Man-Machine Interface; Distributed Processing and Networking.

FRIEDMAN, A.D.—Professor of Engineering and Applied Science.
Computer Architecture and Organization; Switching Theory and Logic Design; Microprocessors; Diagnosis and Fault Tolerant Design of Digital Circuits; Digital System Design Automation.

HARRINGTON, R.J.—Associate Professor of Engineering.
Simulation and Control of Electrical Machinery and Power Systems; Transient Stability; Transmission Line Switching Transients; Computer Modeling.

HELGERT, H.—Professor of Engineering and Applied Science.
Communication and Information Theory; Coding Theory.

HELLER, R.B.—Professor of Engineering and Applied Science.
Information Processing; Computer-to-Computer Communication Networks; Satellite Communications; Electromagnetic Radiation.

HOFFMAN, L.J.—Associate Professor of Engineering and Applied Science.
Computer Science; Security and Privacy; Criminal Justice Information Systems; Social Implications.

KAHN, W.K.—Professor of Engineering and Applied Science.
Antennas; Microwave Components; Fiber Optics; Electrophysics.

KYRIAKOPOULOS, N.—Associate Professor of Engineering and Applied Science.
Computer-Aided Network Design; System Theory; Control Theory; Digital Filtering.

LANG, R.H.—Professor of Engineering and Applied Science.
Wave Propagation in Random Media; Remote Sensing; Phase-Locked Loops; Adaptive Arrays.

LEE, T.N.—Associate Professor of Engineering and Applied Science.
Networks; Linear Systems.

LOEW, M.H.—Associate Professor of Engineering.
Pattern Recognition; Medical Engineering; Image Processing.

MAURER, W.D.—Professor of Engineering and Applied Science.
Computer Science, Correctness of Programs, Analysis of Algorithms; Semantics of Programming Languages.

MELTZER, A.C.—Professor of Engineering and Applied Science.
Design of Computer Systems; Data Base Systems; Multiprocessor Systems; Hybrid Computation.

RICKHOLTZ, R.L.—Professor of Engineering and Applied Science.
Data Communications, Computer Communications Networks; Communications Theory.

ROHLFS, D.C.—Associate Professor of Engineering.
Specialized Measurements and Instrumentation; Electronic Devices; High-Power HF Systems.

ALBERT, J.L.—Associate Research Professor of Engineering.
Computer Graphics, Cartography, Spatial Analysis.

TAGHLOUL, M.—Assistant Professor of Engineering.
Linear and Nonlinear Networks and Systems; Computer-Aided Network Analysis and Design.

Admission

In addition to the School of Engineering and Applied Science requirements for admission to graduate study toward the Doctor of Science degree (see page), applicants for the Doctor of Science degree in the Department of Electrical Engineering and Computer Science must meet the following general and specific requirements.

GENERAL REQUIREMENTS

1. The applicant must be recommended for admission by the Chairman of the Department of Electrical Engineering and Computer Science.
2. The applicant must have a minimum quality-point index of 3.40 (on a scale of 4.00 maximum), or equivalent, in graduate course work leading to the Master's degree.
3. The applicant must be adequately prepared in the basic sciences (physics, and chemistry or biology) and in mathematics (calculus through differential equations).

LANGUAGE REQUIREMENT

A doctoral student should maintain a broad outlook in pursuing his or her study and, therefore, must have the capability of reading appropriate literature published in a foreign language. Accordingly, a reading knowledge of one foreign language must be demonstrated before admission to the Qualifying examination. The student must obtain approval of his or her doctoral adviser before the language is selected.

SPECIFIC REQUIREMENTS

In addition to the above general requirements, the applicant must also satisfy through previous studies the following specific requirements according to the area of concentration (major area):

Communications

Nine semester hours of statistical theory of communication and 3 semester hours of information theory—EE 204, 241, 243, and 244; or equivalent.

Simulation and Numerical Methods

Twelve semester hours of numerical methods at the graduate level—CSci 159, 201, 221, and 281; or equivalent.

Computer Science

Twelve semester hours of computer system design and software beyond the use of a compiler language—CSci 154, 159, 201, and 213; or equivalent.

Electrophysics

Twelve semester hours of electronics and electromagnetic fields and waves at the graduate level—EE 201, 206, 207, and 221; or equivalent.

Energy Conversion, Power, and Transmission

Twelve semester hours of electrical machines theory and networks at the graduate level—EE 261, 262, 264, and 266.

Medical Engineering

Twelve semester hours of medical engineering at the graduate level—EE 280, 281, 282, and 283; or equivalent.

Systems Science, Networks, and Controls

Twelve semester hours in network system analysis at the graduate level, including a knowledge of state space and linear graph theory—EE 202, 204, 212, 272, and 273; or equivalent.

An applicant who fails to meet the above specific requirements, but meets all other admission requirements, may be admitted with a program of study which is increased beyond the minimum requirements so that sufficient background material may be covered for doctoral studies.

Program of Study

At the time of admission, the graduate student in pursuit of a Doctor of Science degree in the Department of Electrical Engineering and Computer Science is assigned a faculty adviser in the major area of study. In consultation with the adviser, the student will determine the two minor areas of study. Together they will formulate a program of study for the student leading to the Qualifying Examination and complete the form "Graduate Program of Study" (Form 1). Programs of study and any subsequent changes must be approved by both the faculty adviser and Department Chairman.

MAJOR AREA

The program of studies for the Doctor of Science degree will normally consist of one major area of concentration and two minor areas totaling a minimum

of 30 semester hours of graduate-level courses (200 and above) beyond the Master's degree level. A minimum of 15 semester hours must be taken in the major area; a minimum of three courses designated with an asterisk in the list of areas of concentration must be included as part of the major area. A student who is changing the major area from that studied for the Master's degree or who is missing specific admission requirements may be required to take additional courses to make up deficiencies. Such additional work should not normally exceed 12 semester hours.

MINOR AREAS

The student in consultation with the faculty adviser formulates a program of study which includes two minor areas as part of the total doctoral studies. For those students who take their minor area studies within the Department of Electrical Engineering and Computer Science, the following courses specify adequate programs in each minor area:

Communications—EE 204; 205 or 241; 243; and 244 or 249

Simulation and Numerical Methods—CSci 201, 221, and 281; or CSci 201, 281, and 224

Computer Science—CSci 201, 213, and 237 or 263

Electrophysics—EE 201, 206, 207, and 221

Energy Conversion, Power, and Transmission—EE 261, 262, 264, and 266

Biomedical Engineering—EE 280, 281, 282, and 283

Systems Science, Networks, and Controls—EE 202, 212, 272, and 273

Minor areas are not confined to the Department of Electrical Engineering and Computer Science, but may be taken from other departments within the University such as Mathematics, Statistics, Operations Research, and Physics. Normally a minimum of three graduate-level courses constitutes a minor area.

QUALIFYING EXAMINATION

The Qualifying Examination for doctoral students in the Department is composed of two parts. All incoming doctoral students must take the first examination within three regular semesters of the date of formal admission into the doctoral program. Students entering as unclassified students with prescribed deficiencies must take the first examination within five semesters of their entrance as unclassified students. This first examination is the Department's Master's Comprehensive Examination (MCE) in the major area. The student must demonstrate superior performance to qualify formally as a student in the Department at the doctoral level. The requirement to take this first examination is waived for a student who has received an M.S. degree from this department within two years prior to entrance, has demonstrated superior performance on the MCE. A student who fails to demonstrate superior performance must take the examination again in one of the two immediately succeeding semesters. A student may take the MCE only two times. Failure to show superior performance on the MCE in the major field twice will result in termination of the student's candidacy.

Upon completion of the student's formal program of study and after demonstrating superior performance on the MCE and passing the foreign language

examination, the student is prepared to complete the Qualifying Examination. The purpose of this second part of the Qualifying Examination is to ascertain that the student's depth and breadth of background and intellectual development are adequate to support doctoral research and investigation in the major area. The second part of the Qualifying Examination is given only in the spring semester. It is composed of a written part covering the major area (one day) and each minor area (one day each). In addition and subsequent to the written examination, there may be an oral examination. The student must pass the entire second part of the Qualifying Examination. A candidate who fails any portion of the Examination on the first attempt may take those portions of the Examination one more time if approval is given by the appropriate examining committee. Failure to pass the Qualifying Examination will terminate the student's candidacy in the doctoral program.

The questions on the Qualifying Examination are not limited to those specific areas in which the student has taken course work, but are designed to demonstrate the student's ability to integrate the material from several course areas as well as from individual study and readings. Hence, the student should be familiar with the contemporary work of the current journals and the contents of the books on the particular reading lists in the areas of examination as well as those used in the course work.

DISSERTATION

After successfully completing the Qualifying Examination, the student makes arrangements for the assignment of a research director (not necessarily the student's faculty advisor), who selects an appropriate advisory committee. The duties of the advisory committee are to be aware of the student's dissertation development and, in conjunction with the research director, to give guidance to the student. After the student completes his dissertation, the advisory committee will become the examining committee with the addition of at least one new person. The dissertation should be of such quality that all or part is suitable for publication in the open literature. Doctoral students are encouraged to publish their work.

Electrical Engineering Graduate Courses*

201 **Natural Modes and Transients in Electrical Systems** (3)
Transient response and natural modes of electrical systems; techniques for analyzing systems with periodic and aperiodic inputs and outputs. Fourier and Laplace transforms. Inversion, integration in the complex plane. Sampling; discrete systems, Z-transforms; applications. Prerequisite: graduate status. (Fall and spring—evening) (Heller)

202 **Linear Systems Theory** (3)
An introduction to linear systems theory. Topics include linear vector spaces and linear operators, mathematical representation of dynamic linear systems, concept of state and solution of the state equation, controllability and observability, canonical forms of the state equation, state feedback, and state estimation. (Spring and fall) (Zaghloul)

203 **Graph Theory and Applications** (3)
An introduction to oriented and nonoriented graphs. Topics may include graph theory applications to the routing problems of multiple printed circuits; circuit concepts of linear vector spaces; network analysis and

* The faculty member whose name appears at the end of each course description is the director for that course. The course director is not necessarily the instructor for any given semester.

synthesis, topological formulas; paths, reachability, connectedness, tree representations, transportation flows, and communication networks. Computer science applications such as storage representation and manipulation of computer data and other related techniques. (Spring, even years) (Zaghloul)

204 **Stochastic Signals and Noise** (3)
Probability, random variables, characteristic functions; transformations of random variables and applications; sequences of random variables, linear mean-squared estimation; stationary estimation, stationary random processes, correlation functions, power spectrum; output of linear systems with stochastic inputs; Gaussian processes. Applications drawn for communications, control theory, computer science. Prerequisite: ApSci 115 or equivalent. (Fall and spring—day and evening) (Lang)

205 **Stochastic Processes in Electrical Engineering** (3)
Markov chains, state classification, Kolmogorov equation; applications to probabilistic finite-state machines. Birth-death process, applications to queuing theory, buffer problems, and the design of communication nets. Continuous state processes, diffusion processes, passage times, and estimation problems. Estimation and power spectra. Stochastic difference and differential equations. Applications to communication theory, control theory, computer science, and propagation theory of random media. Prerequisite: ApSci 115 or equivalent. (Spring—evening) (Lang)

206 **Electromagnetic Theory and Applications I** (3)
Brief review of vector-phasors and Maxwell's equations, electromagnetic potentials, power and energy; plane waves, frustrated total reflection, skin effect, anisotropic media; solution of radiation problems in the Kirchoff approximation; elementary applications. Prerequisite: EE 133 or equivalent. (Fall—evening) (Lang)

207 **Electromagnetic Theory and Applications II** (3)
Introduction to advanced techniques for problems in electromagnetics; leaky waves and complex wave-types, stationary phase and steepest descent approximations for integrals in the complex plane. Discrete and continuous spectra. Application to optical fibers, surface and leaky wave antennas, ground wave propagation. Prerequisite: EE 201 or equivalent, EE 206. (Spring—evening) (Lang)

208 **Digital Image Processing** (3)
Properties of images and visual systems. Picture description, sampling and quantization. One- and two-dimensional image transform techniques including Fourier, Cosine and Hadamard. Methods of image enhancement and restoration. Image coding and data compression techniques. Automated image analysis and recognition. Computer applications and projects. Prerequisite: EE 204. (Spring—evening) (Loew)

212 **Network Analysis** (3)
Network theorems, network functions, network properties, relationship of parts of network functions, realizability and causality concepts. Introduction to the theory of nonlinear networks, nonlinear resistive network equation formulation, hybrid and other nonlinear equations. Nonlinear dynamic network equation formulation, state space, conditions for existence. Concepts of stability in nonlinear networks, conservative and Lagrangian networks and systems. (Fall, odd years) (Zaghloul)

213 **Computer-aided Analysis and Design of Systems** (3)
Numerical solution of algebraic set of equations, Newton-Raphson and modified Newton-Raphson techniques, solution of algebraic equations with multiple solutions. Numerical solution of nonlinear ordinary differential equations, stability, stiff systems, steady state solution of nonlinear

periodically excited networks, computer-aided approach. Numerical optimization techniques, linear and nonlinear programming, gradient methods, unconstrained optimization, quasi-Newton methods, and penalty functions. Computer-aided sensitivity analysis of networks. Application in the design of large systems and in automated design. Prerequisite: EE 202 or 212. (Fall, odd years) (Zaghloul)

215 Linear Network Synthesis I (3)
Properties and testing of positive real functions. Synthesis of LC, RL, RC one-port networks. Brune, Bott-Duffin, Miyata, Kuh, and Darlington synthesis techniques. Introduction to two-port ladder and lattice synthesis. Three-terminal RC network synthesis approximation in the frequency and time domains. Prerequisite: EE 202 or permission of course director. (Spring, odd years—evening) (Lee)

216 Synthesis of Active and Distributed Networks (3)
Active network synthesis using negative resistors, control sources, NIC, operator and operational amplifiers. Uniform and nonuniform distributed network analysis and synthesis—computer-aided design. Prerequisite: EE 215. (Fall, even years) (Lee)

217 Advanced Network Theory (3)
Modern methods for formulating network equations; mixed nodal tableau, state space formulation. Mathematical methods for the solution of network equations, properties of nonlinear functions representing the nonlinear networks, losslessness and passivity in nonlinear networks. *n*-port networks. Piecewise linear networks analysis and techniques. Properties of nonlinear dynamic equations; existence and uniqueness of solution; stability and stability classification; Popov, Liapunov, steady state analysis techniques of nonlinear periodic networks. Other selected topics. Prerequisite: EE 202, 212. (Fall, odd years) (Zaghloul)

219 Digital Filter: Design and Realization (3)
Properties of transfer functions. Filter approximation, sensitivity, and computation techniques. Digital signals and systems, basic block of digital filters, stability consideration. Analysis of digital filters. Design of IIR and FIR digital filters. Computation techniques. Direct and indirect realization of digital filters. Microprocessor implementation. Applications and selected papers. Prerequisite: EE 202 or permission of course director. (Spring, odd years) (Zaghloul)

221 Physical Electronics I (3)
Theoretical principles underlying the operation of electronic devices; classical mechanics and classical statistical mechanics, the quantum theory, wave and matrix mechanics, quantum statistics. Prerequisite: EE 207 or equivalent. (Fall—evening) (Braun)

222 Physical Electronics II (3)
The Boltzmann transport equation, band theory of solids, time-dependent perturbation theory, group theory. Applications to semiconductor and other solid-state devices such as transistors, tunnel diodes, masers, and lasers. Prerequisite: EE 221. (Spring—evening) (Braun)

223 Optical Communications Systems (3)
Optical communication channels; survey of laser sources; modulation; line-of-sight links; system models and analysis; detection, photoemitters, photodiodes, and photoconductors; noise mechanisms and signal-to-noise analysis; optical fiber waveguides, electromagnetic field description of material, waveguide, and modal dispersion; optic fiber cabling, repeaters, and systems analysis; integrated optic components. Prerequisite: EE 207, 243. (Spring, odd years—evening) (Kahn)

224 **Electronics of Lasers** (3)
Basic concepts from quantum mechanics; Einstein coefficients; inversion and pumping mechanisms; rate equations. Resonators, He-Ne laser; organic dye lasers; injection lasers. Nonlinear interactions in lasers. Prerequisite: EE 222 or equivalent. (Fall, 1981 and every third year thereafter—evening) (Kahn)

225 **Nonlinear Electronics** (3)
Analysis and design of electronic components and systems operating as switching, sweeping, gating, and pulse generators; study of multivibrators, negative resistance devices and amplifiers, nonlinear operation of oscillators. Prerequisite: EE 201 or equivalent. (Fall, even years—evening) (Heller)

226 **Fiber and Integrated Optics** (3)
Single-mode and multimode propagation in stepped-index and gradient-index optical fibers: scattering and attenuation characteristics of fibers, phase velocity, group velocity, impulse response, energy transport, ray tracing, Goos-Haenchen shift, Hamiltonian formalism; directional couplers, modulators, and deflectors in fibers and surface films; coupled-mode theory. (Spring, even years—evening) (Kahn)

227 **Industrial Electronics** (3)
Applications of electronic devices in industry; continuous and sampled control systems; induction and dielectric heating; timing and counting circuits; reliability and automatic checking equipment; digital control of machine tools. Prerequisite: EE 201 or equivalent; and graduate status. (Spring, odd years—evening) (Heller)

228 **High-frequency Electronics** (3)
Design and analysis of the operation of electron-tube, solid-state, crossed-field, space-charge wave, and quantum maser oscillators and amplifying devices that lay the foundation of modern communication systems. Prerequisite: EE 207 or equivalent. (Spring, even years) (Heller)

231 **Field Analysis and Potential Theory** (3)
General study of the theory of potentials as used to facilitate solution of problems in electromagnetic theory, mechanics, thermodynamics, optics, and gravitation. Emphasis on mathematical methods such as Green's functions, variational methods, principal axis transformations, and multidimensional Fourier transforms. Prerequisite: EE 207. (Spring, 1981 and every third year thereafter—evening) (Heller)

232 **Electrodynamics** (3)
Special theory of relativity and the Lorentz transformation; Minkowski formulation. Maxwell's equations in the context of special relativity, electromagnetic potentials, and stress tensors. Lagrangian and Hamiltonian formulations, radiation from moving charges. Introduction to quantum electrodynamics. Prerequisite: EE 207. (Spring, 1982 and every third year thereafter) (Braun)

*233 **Microwaves and Components** (3)
High-frequency transmission lines and guided systems; matching techniques; scattering parameters; transfer parameters; directional couplers; cavity resonators; Faraday rotation; ferrite isolators and circulators. Prerequisite: EE 207. (Fall—evening) (Kahn)

234 **Electromagnetic Wave Propagation** (3)
Retarded time scalar, vector, and Hertz potential. Dipole and dipole array fields; Mie theory of electromagnetic scattering by spheres. Propagation in electrically and magnetically anisotropic media such as dielec-

* not be offered Fall, 1982.

tric crystals, space-charge plasmas, and ferrites. Wave propagation in inhomogeneous media; Liouville transformation, Lagrange's variation of parameters, WKB solution, invariant imbedding techniques. Propagation in stochastic and dispersive media. Prerequisite: EE 207. (Fall, even years—evening) (Lang)

235 Antennas (3)
General solution of Maxwell's equations in terms of current sources, polarization, the far field approximations, radiation from current distributions, field equivalence theorems, the geometrical optics approximation, aperture antennas, receiving antennas, the theory of arrays, and applications to specific antennas and antenna types. Prerequisite: EE 207. (Spring, odd years—evening) (Kahn)

236 Plasma Dynamics (3)
Study of the interaction of fluids with electromagnetic fields. Generalized Navier-Stokes and energy equations, magnetogasdynamic and magnetohydrodynamic approximations, boundary-layer theory, statistical theory of turbulence, generalized Von Karman-Howarth equation, Boltzmann transport equation. MHD generators and devices. Prerequisite: EE 207. (Fall, 1983 and every third year thereafter) (Braun)

237 Waves in Random Media (3)
Propagation and scattering of electromagnetic, optical, and acoustic waves in random media, scattering from rough surfaces and randomly distributed particles, turbulence. Applications to propagation through rain and fog. Laser beam scintillations, remote sensing, and communication channel modeling. Computer simulation by Monte Carlo techniques. Prerequisite: EE 204, 207. (Spring, even years—evening) (Lang)

238 Remote Sensing (3)
Description and analysis of active and passive remote sensing systems including scattermeters, real aperture imaging and synthetic aperture radars. Sensing of surface, subsurface and atmospheric parameters at microwave, infrared and optical frequencies. Analysis of radiometric techniques using radiative transport theory; inverse scattering methods; profile inversion. Prerequisite: EE 207. (Spring, odd years—evening) (Lang)

239 Numerical Laboratory in Electromagnetics (3)
Numerical methods for the solution of electromagnetic problems dealing with scattering by complex shapes, antenna design, transmission through anisotropic and dispersive media, electrodynamic interactions with charged particles. Convergence experiments dealing with moment methods, hybrid GTD, variational computations. Prerequisite: EE 207 and CSci 100. (Fall, even years—evening) (Kahn)

241 Information Theory (3)
Measure of information, noiseless coding; communication channels, channel capacity, the noisy channel coding theorem; bounds on the performance of communication system; the Gaussian and binary symmetric channel; feedback communications systems; rate-distortion theory. Prerequisite: EE 204. (Fall—evening) (Chang)

242 Coding Theory (3)
The PCM Communication System, mathematics of coding; groups, rings, and fields; linear codes: parity and generator matrices, syndromes error correction and deletion capability, minimum distance; performance bounds of linear codes, Hamming and Golay codes, polynomial algebras and Galois fields, shift-register implementation; cyclic codes: implementation and performance; BCH codes: encoding, decoding, minimum distance, the BCH decoding algorithm, burst-correction codes, convolutional codes,

sequential and Viterbi decoding of convolutional codes. Prerequisite: EE 204. (Spring—evening) (Chang)

243 **Communication Theory I** (3)
Optimum receivers for vector channels and for the additive white Gaussian noise channel; correlation detectors, matched filters; coherent and noncoherent detection and their error probabilities for simplex, orthogonal, and coded systems; bounds on the performance of communications in Gaussian noise; comparison of communications systems. Prerequisite: EE 204 or equivalent. (Fall—day and evening; spring—evening) (Pickholtz)

244 **Communication Theory II** (3)
Schemes for efficient signaling for data sequences; effects of quantizing at the receiver. Practical implementation of orthogonal and simplex coded communication. Convolutional codes; bounds on performance decoding by sequential (Zigangirov-Jelinek, Fano) and MAP (Viterbi) algorithms. Fading and dispersive channels, diversity techniques and their performance. Topics from analog communications. Prerequisite: EE 243. (Spring—day and evening) (Pickholtz)

245 **Signal Detection and Estimation Theory** (3)
Statistical detection theory, hypothesis testing, sequential detection, estimation theory, maximum likelihood and Bayes methods, estimation of signal parameters and continuous wave forms, Wiener and Kalman filters, applications to the design of optimum receivers, adaptive systems. Prerequisite: EE 241, 244; or equivalent. (Fall—evening) (Pickholtz)

246 **Digital Communications** (3)
Digital transmission for data, voice, and video. Modern practice in data communication; voice digitization, PCM, delta modulation, linear predictive coding. Bounds for digital signaling, pulse dispersion and intersymbol interference. Nyquist criteria, eye openings; adaptive equalizers, decision feedback, partial response techniques. Regenerative repeaters; timing extraction, synchronization and jitter. Transmission codes. Multiplexing and framing. Error control for data. Digital switching and integrated digital networks. Prerequisite: EE 241, 244 or equivalent. (Spring—evening) (Pickholtz)

247 **Communication Systems** (3)
Analysis and design of coherent communication systems. Phase-locked loop dynamics noise behavior and optimization. Parameter estimation theory and Wiener filters with application to optimum demodulation of analog waveforms (DSB-AM, SSB-AM, FM). Partially coherent digital demodulation. Comparative analysis of modulation systems. Frequency acquisition and synchronization. Selected topics in channel impairments and multiple access. Prerequisite: EE 241, 244. (Fall—evening) (Pickholtz)

248 **Data Communication Systems** (3)
Introduction to data networks. Common carriers, specialized carriers, value added networks. Operations, facilities, services, tariffs. Data transmission over the telephone network. Channels, carriers systems, hierarchies. Terminals, modems, multiplexors, concentrators, communication processors. Standards and protocols. Coding for error control, data encryption. Data transmission via satellite. Communication software. Survey of domestic and foreign data networks. Regulatory and economic issues. (Fall—evening) (Helgert) (Should be taken in sequence with EE 249.)

249 **Theory of Data- and Computer-Communication Networks** (3)
Design and analysis of computer-communication and terminal oriented networks. Line, message and packet switching. Traffic theory for data.

Queuing models. Delay and cost minimization, topological design algorithms. Network routing, polling, and flow control. Analysis and design of protocols for packet switched structures. Prerequisite: EE 204 or 205. (Spring—evening) (Pickholtz) (Should be taken in sequence with EE 248)

*250 **Telecommunication Systems Concepts** (3)
Essential elements of an electrical communication system, speech, TV, and data signals; spectrum, bandwidth, sampling. Amplitude, frequency, and pulse code modulation and comparative performance. Multiplexing schemes, communication quality standards, and objectives. Signal power, noise power, distortion, and channel capacity. Probability, traffic theory, reliability, voice, TV, and data transmission. Telecommunication, microwave radio, cable, and satellite communications systems. (As arranged) (Pickholtz)

*251 **Survey of Telecommunication Systems** (3)
Design of a communications link for voice, TV, and data. Loading; the switched telephone network. Transmission system layout and major design considerations. Overall system design of microwave radio system. Radiowave propagation fundamentals. Satellite communications, factors affecting the choice of orbit and orbital separation of satellites, satellite transponder. Major design consideration and values of significant parameters for a typical satellite communications link. Overall design of a cable communication system. Digital transmission and terminals. Wideband data transmission. Frequency allocation. (As arranged) (Pickholtz)

252 **Digital Signal Processing Techniques** (3)
Signal representations, sampling and quantization, transform techniques. Recursive estimation, linear predictive filtering, recursive and nonrecursive digital filter design. Computer-aided design. Prerequisite: EE 51 or equivalent. (Fall, even years) (Zaghloul)

253 **Sonar Systems** (3)
Underwater sound propagation; transducer and transducer arrays; detection, localization, and tracking techniques; array processing; time compression correlation and digital processing of signals; effects of nonhomogeneous noise fields; applications to navigation and communications in the ocean environment. Prerequisite: EE 204. (Fall—evening) (Helgert)

254 **Radar Systems** (3)
The radar equation, range and resolution limits; MTI radars; detection and estimation techniques; clutter characteristics and detection in clutter; signal design; ambiguity functions; Doppler radar; phased arrays; synthetic aperture techniques; digital and optical processing and computer control. Applications. Prerequisite: EE 206, 244. (Spring—evening) (Helgert)

255 **Optical Processing** (3)
Fourier transforms by diffraction of light, optical spectrum analysis, optical memories and systems, holography and holographic techniques, properties and techniques for photographic reproduction. Prerequisite: EE 201. (Fall, even years—evening) (Kahn)

257 **Secure Communications** (3)
Spread-spectrum techniques, time and frequency hopping, direct sequence encoding. Link jamming models and jamming effectiveness. Adaptive null steering arrays, nulling algorithms, effects of intelligent jammers. Data link encryption, data encryption standards and public key cryptosystems. Prerequisite: EE 242, 244. (Fall—evening) (Pickholtz)

* EE 250–251 cannot be applied toward a graduate degree in the School of Engineering and Applied Science.

258 Radio Communication Systems I (3)

Analysis and design of microwave communication systems for terrestrial, satellite, and over-the-horizon scatter radio channels. Propagation effects and channel characterization including refraction, reflection, multipath, scattering, and absorption. Effects of earth curvature and characteristics of over-land and over-water propagation. Antenna considerations including gain, directivity, polarization, and antenna patterns. Frequency and time-division multiplexing and modulation techniques. Effects of noise, interference, and fading. Diversity techniques. Prerequisite: EE 206, 244. (Fall—evening) (Lang)

259 Radio Communication Systems II (3)

Morphology of the ionosphere, propagation of ionspherically reflected radiowaves, anomalous ionospheric propagation mechanisms, linear antenna structures, atmospheric noise, digital modulation techniques, non-Gaussian channel performance, diversity, fading channel error control, typical VLF, LF, and HF system design. Prerequisite: EE 258 or permission of instructor. (Spring—evening) (Lang)

261 Electromechanical Energy Conversion (3)

Characteristics of synchronous machines, synchronous reactance, reactance theories, synchronizing generators and parallel operation of machines, characteristics of asynchronous machines, machines as circuit elements. Steady-state and dynamic performance of alternating current machines. Prerequisite: EE 202, 206, or permission of course director. (Fall—evening) (Harrington)

262 Control of Rotating Machinery (3)

Dynamic requirements of industrial drives. Detailed analysis of inverter circuits. Frequency control of inverter drives and cycloconverters. Computer modeling of rectifier and inverter circuits. Feedback control loops and their effect on stability. Prerequisite: EE 177, 201, 202, 206, 261, or permission of course director. (Spring—evening) (Harrington)

263 Design of Reliable Emergency and Standby Power Systems (3)

General requirements and guidelines. Factors affecting power line disturbances. Characteristics and settings of system protection. Disturbance effects on computer power supplies. Grounding and noise control. Evaluation of reliability of power systems. Reliability evaluation from an economic viewpoint. Cost of power outages. Reliability of specific equipment. Practical application problems. Prerequisite: EE 202, 206, or permission of course director. (Spring—evening) (Harrington)

264 Direct Electrical Energy Conversion (3)

Theory and practice for direct production of electricity using solar cells, thermionic converters, fuel cells, and batteries. Concepts of solid state energy bands, work function and conversion efficiency, and limitations. Prerequisite: EE 202, 206, or permission of course director. (Spring—evening) (Harrington)

265 Transients in Electrical Power Transmission Lines (3)

(Formerly Electrical Power Production)

Theory of traveling wave phenomena in electrical power transmission lines. Switching and lightning surges and the resultant overvoltages on long lines for various terminations. Breaker closing sequence effects and effect of source side inductance and multiple infeeds. Recovery voltage after short line faults. Methods and effectiveness of protection. Analysis of transient corona and its effect on wave shape. Methods of automatic calculation of overvoltages in complex systems and insulation level re-

quirements. Prerequisite: EE 202, 206, or permission of course director. (Fall, odd years—evening) (Harrington)

266 **Electrical Power Transmission** (3)
EHV AC and DC power transmission. Overhead and underground cable transmission systems. Computer simulation and analysis of transmission line transients, insulation coordination, optimum loading of transmission facilities. Prerequisite: EE 178, 202, 206, and permission of course director. (Spring, even years—evening) (Harrington)

267 **Power Networks** (3)
Symmetrical components, short- and open-circuit analysis of power networks. Stability of electrical grids, fault analysis, and load flow analysis. Prerequisite: EE 177, 178, 202, 206, 266, and permission of course director. (Fall, even years—evening) (Harrington)

268 **Electrical Power Distribution** (3)
Transformer and insulation design at distribution voltage levels. Medium and low voltage switchgear requirements. Protective relaying, harmonic filtering, power factor correction, grounding systems. Prerequisite: EE 178, 202, and permission of course director. (Spring, odd years—evening) (Harrington)

269 **Overall Electrical Power Generation Plant Design** (3)
Energy source design, boiler and turbine design and construction, synchronous generator and transformer requirements. Power station auxiliary plant. Exciter and governor design. Prerequisite: EE 177, 178, 202, 206, 261, 265, and permission of course director. (Fall, odd years—evening) (Harrington)

271 **Linear Multivariable Control Theory** (3)
Control of systems having multiple inputs or outputs. Topics useful in the control of multivariable systems include the algebraic theory of multivariable feedback; static and dynamic decoupling; invertibility; modal control; integrity; computer-aided frequency domain techniques such as feedback design, using inverse Nyquist arrays and characteristic loci design. Prerequisite: EE 172, 202, or equivalent. (Spring, even years) (Carroll)

272 **Computer Control Systems** (3)
An analysis of automatic control systems in which the control procedure uses on-line digital computation. Topics include single and multirate sampling, Z-transforms, responses of discrete systems, stability criteria, discrete control design. Prerequisite or concurrent registration: EE 202 (Spring or fall) (Carroll)

273 **System Optimization** (3)
Parameter optimization problems; theory of minima and maxima. Optimization problems for dynamic systems; calculus of variations; the maximum principle and the Hamilton-Jacobi equation. Optimization problems with constraints; optimal feedback systems. Numerical solution of optimal problems. Prerequisite: EE 203 or equivalent. (Spring—evening) (Carroll)

274 **Nonlinear Systems** (3)
Definition of linear and nonlinear systems; introduction to approximate analysis of nonlinear systems—describing functions, Krylov and Bogoliubov's asymptotical method and Tsypkin's locus. Forced oscillations—jump resonance. Stability analysis—Liapunov's criterion, Lure's problem, and Popov's method. Prerequisite: EE 203. (Spring, odd years—evening) (Carroll)

275 **System Identification and Adaptive Control Systems** (3)
Identification is the process of mathematically modeling a system based on measurement data that may be limited or uncertain. Adaptive control is the means whereby a system that is poorly modeled is controlled adequately. Various approaches to each of these problems are discussed, including the least-squares approach of identification and the stability approach to adaptive control. Prerequisite: EE 202, 204. (Spring—even years) (Carroll)

276 **Cybernetics** (3)
Principles of machines or mechanisms made by men or nature with regard to their ways and forms of possible behaviors: regular, determinate, or reproducible; fundamental concepts of finite differences; changes and transformations as sets of transitions, leading to stability and feedback; statistical concepts of complex systems and blackbox theory; Shannon's information theory; regulation and control of mechanisms. Prerequisite: EE 204 or equivalent. (Fall, odd years—evening) (Helgert)

277 **Satellite Communication Systems** (3)
Theoretical and applications aspects of satellite communications. Modulation and multiple access techniques. Link design. Satellite transponders and antenna systems. Ground stations. Random access techniques and satellite packet communications. Prerequisite: EE 244. (Fall—evening) (Pickholtz)

278 **Spacecraft Systems Design** (3)
Space environment; structure, propulsion, control, and instrumentation of spacecraft—launch, orbit, transit, and re-entry problems; bioastronautic considerations. Prerequisite: graduate status. (Spring, even years—evening) (Heller)

279 **Stochastic Control Systems** (3)
Introduction to random process in control; properties of Markov process, systems of covariance equivalence, of deterministic and stochastic control equivalence; dynamic programming for Markov process—principle of optimality; linear systems with quadratic cost, Kalman filtering, smoothing and predicting. The separation theorem and applications concepts of adaptive estimations. Prerequisite: EE 204, 273. (Fall, odd years) (Lee)

280 **Introduction to Medicine for Engineers I: Physiology and Anatomy** (3)
Designed to acquaint the engineering student with the physiology of the human body as taught from a systems viewpoint; concepts of cellular structure and function integrated into the tissue and organs, which are then related to the various systems of the body; interrelationships of the body systems, i.e., the interaction of the nervous system with the musculoskeletal system or the interaction of the respiratory system and its functions with the cardiovascular system. (Fall—evening) (Eisenberg)

281 **Introduction to Medicine for Engineers II: Physiology and Anatomy** (3)
Further elaboration of physiological systems, such as the endocine system, renal physiology, gastrointestinal physiology, and others; the separate systems of the body are integrated to present the functioning of the body as an overall system. Prerequisite: EE 280. (Spring—evening) (Eisenberg)

282 **Medical Instrumentation I** (3)
Theory of measurements in biological areas, techniques for electronic measurements on biological specimens, current problems in medical metrology stressing electronic systems. Prerequisite: EE 280 or permission of course director. (Fall—evening) (Eisenberg)

283 **Medical Instrumentation II** (3)
Medical telemetry systems, medical use of the computer, engineering techniques in patient treatment, principles of good medical instrumentation. Prerequisite: EE 280 or permission of course director. (Spring—evening) (Eisenberg)

285 **Sensory-evoked Potentials I** (3)
Physiological significance of the sensory-evoked potential, stimulation variables, subject variables, data acquisition procedures and instrumentation, signal-averaging computers, analysis techniques for the VEP, applications of the VEP. Lectures, discussion, and laboratory. Prerequisite: EE 280, 281, 282, 283, or permission of course director. (Fall—evening) (Eisenberg)

287 **Rehabilitation Engineering** (3)
Application of engineering theory and techniques to the rehabilitation of handicapped persons; major problem areas and general approaches, as well as specific solutions. Prerequisite: EE 281. (Spring, odd years—day) (Eisenberg)

289 **Clinical Engineering** (3)
A cross-sectional view of clinical engineering applications, functions, variations, and patterns in the medical and allied health care area. Use of instrumentation, computers, and systems by clinical engineers in hospitals and clinics. The clinical engineer in cardiovascular measurement systems and intensive care units; other areas where functional usage of clinical engineering is applicable. Prerequisite: EE 281. (Fall, even years—evening) (Eisenberg)

298 **Research** (arr.)
Research as arranged. May be repeated for credit. (Fall and spring)

299–300 **Thesis Research** (3–3)
(Fall and spring)

319 **Systems Science, Networks, and Controls Research** (arr.)
Limited to students preparing for the Doctor of Science qualifying examination. May be repeated for credit. (Fall and spring)

321 **Approximate Mathematical Techniques for Electromagnetics** (3)
Asymptotic methods for Maxwell's equations, geometric optics, WKB approximation for stratified media, uniform expansion near a caustic and shadow boundary; perturbation techniques for tenuous medium—Rayleigh Gans approximation, smoothing and multivariable methods for stochastic problems. Prerequisite: EE 204, 207. (Spring, 1982 and every third year thereafter) (Lang)

322 **Advanced Waveguide Diffraction and Design** (3)
Selections from the following: Analytical treatment of waveguide bifurcations and discontinuities by Wiener-Hopf, mode matching, static approximation, and other techniques. Small apertures (obstacles) in waveguides. Variational methods for evaluation of equivalent circuit parameters. Group theoretic methods for symmetrical junctions. Prerequisite: EE 233. (Fall, 1982 and every third year thereafter) (Kahn)

323 **Principles of Microelectronics** (3)
Basic principles, techniques, and processes necessary for understanding microelectronics. Semiconductor physics, phase diagrams, crystal growth, epitaxy, vacuum techniques, thin-film deposition, diffusion, oxidation, junction formation, masking, and properties of thin films and materials. Prerequisite: EE 222 or equivalent. (Fall, odd years—evening) (Heller)

329 **Electrophysics Research** (arr.)
Limited to students preparing for the Doctor of Science qualifying examination. May be repeated for credit. (Fall and spring)

345 **Advanced Detection Theory** (3)
Review of general estimation equations. Linear estimation; Weiner and Kalman-Bucy filters; nonlinear modulation theory; angle-modulation systems, analysis and design of phase-lock loops, optimum angle-modulation, rate distortion theory; Gaussian processes in Gaussian noise, detection and parameter estimation, canonical receivers, structures, and performance calculations for diversity systems, multiple pulse radars, stationary processes, and threshold receivers. Prerequisite: EE 245. (Spring—evening) (Pickholtz)

346 **Communications Switching and Traffic Theory** (3)
Switching network technology, step-by-step common control, stored program electronic switching systems. Traffic models. Engineering of multiple server systems, analysis of graded multiples and multistage connecting networks. Software issues, digital time division and store and forward switches. Analytical bounds on the complexity of switch networks, combined circuit and message switching. Current practice and practical issues. Prerequisite: EE 243 or permission of course director. (Spring, even years—evening) (Pickholtz)

347 **Data Communications** (3) (Same as CSci 244)
Principles and practice of modern data communications. Modes for data transmission; terminals, modems, multiplexors, concentrators. Line control procedures. Protocols for buffer management, message reassembly, queue control. Distributed processing; terminal-oriented systems, data collection loops, multi-drop lines. Switched data systems; circuit and packet switching. Error control, cryptosecurity. Hardware and software interfacing. Prerequisite: EE 243 and CSci 201, 202, or permission of course director. (Spring—evening) (Pickholtz)

349 **Communications Research** (arr.)
Limited to students preparing for the Doctor of Science qualifying examination. May be repeated for credit. (Fall and spring)

369 **Issues in Electrical Power Generation and Transmission** (3)
(Formerly Issues in Electrical Power Systems)
Assessment of various energy systems. Interfacing of different types of energy systems. Dispersed generation; concepts of conversion and cogeneration. Pollution control. Biological effects of high electric and magnetic fields. Prerequisite: EE 202, 206, 261, 265, and permission of the course director. (Spring, odd years—evening) (Harrington)

371 **Simulation Methods for System Analysis** (3)
Survey of simulation languages. Techniques of model building for material- and machine-based systems. Treatment of these systems with notion of transactions and states. Modeling the dynamic processes of growth problems. Analog, hybrid, and digital methods for simulation treated by means of case studies; speed and cost of alternate computing procedures. Project-type problems used to illustrate simulation methods. Prerequisite: CSci 278 or permission of course director. (Fall, odd years—evening) (Bock)

372 **Analysis and Control of Large Systems** (3)
Systems as multistage decision processes. Analytical concepts of model-making and matrix representations of large systems. Approximation by models of lower dimension—reduction to simplified models; decentralized systems. Differential games; computation of saddle points; construction of

an equilibrium point. Prerequisite: EE 273. (Fall, even years—evening) (Lee)

380 **Bioelectric Phenomena** (3)
Mathematical treatment of selected bioelectric phenomena. Membrane thermodynamics; membrane electrical potentials and subthreshold membrane effects; membrane dynamics. Solid-state phenomena in biology and medicine. Photoconduction. Mechanism of nerve propagation. Electrical models of the heart. Cell physiology. Quantum effects in biological systems. Prerequisite: EE 206, 280, 282, 283. (Fall, odd years—evening) (Eisenberg)

381 **Computer-aided Analysis of Physiological Signals** (3)
Computer analysis of physiological data obtained from the cardiovascular, pulmonary, and nervous systems. Sources and detection of various signals obtained from these systems; preprocessing of real signals; algorithmic techniques applicable to the analysis of these signals. Students are provided with real data and develop computer software for determining pertinent medical parameters as established by physicians. Prerequisite: EE 280, 281, 282, 283, and a working knowledge of FORTRAN. (Spring, odd years—evening) (Loew)

382 **Physiological Controls and Systems** (3)
Some applications of control and systems theory in the medical and biological fields. Application of general control and systems theory as applied to physiological systems. Specific applications of control and systems theory to the visual system, respiratory system, cardiovascular system, and musculoskeletal system. Prerequisites: EE 172 or equivalent; EE 280, 281, 282, 283. (Spring, even years—evening) (Loew)

385 **Sensory-evoked Potentials II** (3)
A continuation of EE 285. Advanced lecture, discussion, and laboratory. Current topics in sensory-evoked potentials research; emphasis on clinical applications. Planning and conducting an advanced (clinical or research) project chosen to take maximum advantage of the student's technical background from an instrumentation, computer, and data analysis viewpoint. Prerequisite: EE 285 and permission of course director. (Fall, odd years—evening) (Eisenberg)

389 **Medical Engineering Research** (arr.)
Limited to students preparing for the Doctor of Science qualifying examination. May be repeated for credit. (Fall and spring)

399 **Dissertation Research** (arr.)
Limited to Doctor of Science candidates. May be repeated for credit. (Fall and spring)

Computer Science Graduate Courses

201 **Introduction to Computer Systems** (3)
Introduction to programming digital computers in assembly languages. Architecture of traditional von Neumann and stack-based computers. Techniques in machine control and memory addressing. Number systems and codes. Techniques of structured programming. Use of a higher-level procedural language. Stacks and recursion. (CSci 201 is equivalent to CSci 157 and 158.) Prerequisite: CSci/EE 51 or CSci 100 or equivalent (FORTRAN) and programming experience using assembly language. (Fall and spring—evening) (Bock)

203 **Microprocessors and Microcomputers** (3)
Microcomputer structure and components. Microprocessor architecture, registers, ALU, stacks, information flow, and control. Microprocessor support hardware, RAMS, ROMS, PLA's, counter timers. Hardware and

software of typical 8-bit microcomputers. I/O structure in microcomputers; interrupts and DMA operations. 16-bit microprocessors, hardware structure and software capabilities. Bit-slice microprocessors. Prerequisite: CSci 154 or permission of course director. (Fall—evening) (Abd-Alla)

208 **Computer Programming** (3)
Use of a macroassembler in structured programming. Input/output programming at the assembly level. I/O buffer pools and their management. Program status and control, interrupt handling, reentrant subroutines. Linkers and loaders. Utilities. Introduction to operating systems and job control languages. Prerequisite: CSci/EE 158 and 157 or CSci 201 or permission of course director. (Fall—evening) (Maurer)

213 **Discrete Structures in Computing** (3)
Introduction to discrete mathematical structures used in computing. Sets, graphs, functions, mappings, lattices, groups, and semigroups. Combinatorial problems and enumerations. Finite-state machines, representations, identification, transitions, and reductions. Directed graphs, trees, and paths through a program. Regular expressions and relations between programs and computing machines. Prerequisite or concurrent registration: CSci 51 or CSci 100 and permission of course director. (Fall and spring—evening) (Pickholtz)

215 **Advanced Data Structures and High-Level Algorithms** (3)
Sparse matrix transpose and multiplication. List insertion and deletion, lists of available space. The boundary tag method, the Deutsch-Schorr-Waite algorithm, the Knuth-Morris-Pratt algorithm. Inorder, preorder, and postorder traversal of trees, alpha-beta pruning, Tarjan's UNION and FIND. Depth-first and breadth-first search, Kruskal's algorithm, topological sorting, shortest paths in a graph. Quicksort, heap sort, radix sorting, merge sorting, sorting of files. Binary search trees, including AVL trees, B-trees and tries. Hashing and collision handling. Critical paths and PERT. Prerequisite: CSci 159. (Spring—evening) (Berkovich)

216 **Information Retrieval Systems** (3)
Information organization and retrieval of natural language data by digital computer systems; statistical, syntactic, and logical analysis of natural language used for retrieval systems; dictionary systems including thesaurus look-up and phrase structures; searching strategies and cataloguing. Input preparation and output structures; large-scale file structures and operating systems required for their use. Prerequisite: CSci 159; or permission of course director. (Spring—evening) (Foley)

219 **Interactive Computer Graphics I** (3)
Architecture and implementation of display and interaction devices. Interactive graphics programming. Functional capabilities of graphics packages. Implementing a graphics package. 2D and 3D viewing, clipping, and transformations. Interaction techniques and human factors. Raster graphics scan-conversion algorithms. Hidden surface and hidden edge removal algorithms. Shading and texturing techniques. Prerequisite or concurrent registration: CSci 159 or permission of course director. (Fall—evening) (Foley)

220 **Pattern Recognition** (3)
Applications of pattern recognition, vector spaces, estimation and samples; Bayes estimation; density functions; stochastic approximation; decision rules in pattern recognition, minimal risk, Gaussian filters; bounds of risk, nearest-neighbor decision rules; clustering techniques, feature extraction. Sequential and nonparametric methods. Pattern recognition with *a priori* knowledge. Introduction to syntactic methods. Computer applications and projects. Prerequisite: EE 204. (Fall—evening) (Loew)

221 **Simulation and Heuristics** (3)
(Formerly CSci 223)
Techniques of deterministic and probabilistic simulation on the digital computer. Mathematics for simulation; design of systems modules; random number generation and testing. Markovian and bounded context systems; generation of stochastic variates: Monte Carlo techniques; heuristics; verification techniques; simulation languages. Prerequisite: ApSc 115, CSci/EE 157, 158, or CSci 159, 201, and permission of course director. (Fall—evening) (Bock)

222 **Design of User-Computer Dialogues** (3)
Design of dialogues for interactive terminal systems, including graphics systems. Psychological, physiological, linguistic, and perceptual factors. Advantages and disadvantages of various interaction techniques, command language syntaxes, and data presentations. Design methodology and guidelines. Case studies, research readings, and projects. Prerequisite: CSci 159 or permission of course director. (Spring—evening) (Foley)

223 **Computational Heuristics** (3)
Learning stochastic automata theory. Collective and hierarchical automata. Markovian and bounded context systems. State transition descriptions of processes. Environment policies. Stationary and nonstationary compensation policies. Update algorithms. Algedonic processes. Optimality and expediency criteria. Application of inductive learning methods to artificial intelligence. Expectation and confidence criteria for verification. Class projects to illustrate heuristic methodologies. Prerequisites: CSci 157 and 158, or 201; 159; 221; or permission of course director. (Spring—evenings) (Bock)

224 **Artificial Intelligence** (3)
Survey of topics. Analogies and simple concepts. Symbol manipulation and programming in LISP. Networks and simple learning. Scene analysis and sentence analysis. Programming the BLOCKS world. Depth-first and breadth-first searching, hill-climbing, network searching, min-max and alpha-beta pruning. Problem-solving systems. Prerequisite: CSci 159. (Spring—evening) (Bock)

226 **Robotics** (3)
Industrial automation. Manipulator and sensor technology. Feedback loops and analog servos. Multiple degrees of freedom and coordinate systems. Joint-space/work-space transformations and data structures. Point-to-point continuous path control. Robot control: command languages, navigation and mapping, optical and acoustic ranging and pattern recognition, collision avoidance algorithms, positioning accuracy, resolution, and repeatability. Distribution of intelligence. Adaptive hierarchical control. Class projects using the Mobil Robot in the Interactive Systems Lab. Prerequisites: CSci 221 or permission of course director. (Spring—evening) (Bock)

227 **Management Information Systems and Data Base Management** (3)
Concepts in management information systems. Commercial programming features of COBOL and PL/I. Inverted files and query systems. Editing, report generation, updating, and updating load. Tradeoff between direct access and indexed-sequential access. Maintaining large programming systems which lead to the need for data base management systems; construction of data base management systems. Survey of some existing data base systems. Relational data base concepts and future developments. Students will do conceptual and logical design of a database. Prerequisite: CSci 159. (Fall—evening) (Berkovich)

229 Security and Privacy in Computer Systems (3)
Techniques for security of data and programs in computer systems. Authentication methods, logging, authorization, encryption, problems of statistical inference. Effects of operating systems and machine architecture on security. Cost trade-offs and risk analysis among various countermeasures. Theoretical models. Related nontechnical measures. Effect on system design of legal constraints on data banks. Current and potential legal constraints. Prerequisite: CSci 159 or equivalent. (Fall—evening) (Hoffman)

*230 **Information Policy** (3)
Topics of current interest in information policy, including privacy, freedom of information, antitrust and other business implications of policies, transborder data flow, information as a "weapon," cryptographic policy, international aspects of information law and policy, technology transfer, electronic funds transfer, electronic mail, criminal justice information systems, and cross-cultural implications and the lower classes. Prerequisite: CSci 100 or equivalent. (Spring—even years) (Hoffman)

231 Sequential Machines (3)
Finite state sequential machine theory and design, state identification, information losslessness, state minimization in incompletely specified tables partition theory, decomposition of machines, asynchronous machine design, structural simplicity and design with ROM's and PLA's (Planar Logic Arrays). Prerequisite: EE, CSci 153. (Fall—evening) (Friedman)

232 Automata and Formal Languages (3)
Regular expressions including equality and transformations between sequential machines and regular expressions. Turing machines, recursive functions, predicate calculus, and computability. Complexity of algorithms. Formal language theory including grammatical construction, recognizers, relationships between machines and grammers. Nondeterministic automata. Prerequisite: CSci 213. (Spring—evening) (Feldman)

237 Computing Systems (3)
Organization of large digital computer systems. Design of high-speed arithmetic units. Random access and associative memories; rotational storage devices; computer control and interrupt structures. Input-output channels and interfacing problems. Communications in digital computers. Introduction to multiple-access and time-sharing systems. Prerequisite: CSci/EE 154. (Fall—evening) (Abd-Alla)

239 Comparative Computer Systems (3)
Structures of computers and a general language for system description. History of different computer structures. Development of the operating system. Special purpose processors. Multiprocessors and large computing systems. Computer networks and time-shared systems. Comparison of computer families. Characteristics and philosophies of computer design of the major manufacturers. Introduction to performance evaluation and measurement. Effects of software and technology on computer structures. Prerequisite: CSci 208, 237. (Spring—evening) (Meltzer)

240 Theory and Practice of Microprogramming (3)
Basic concepts, techniques, and theory of microprogramming as applied to the implementation of control systems for sequential machines. Microprogramming languages, assemblers, and hardware simulators, including specific applications of these to the design of current computer systems and their interfaces with real-time systems. Prerequisite: CSci 157, 237. (Spring—evening) (Abd-Alla)

* (50) is not to be counted as part of the major course offering in computer science.

243 **Fault Tolerant Systems and Design Automation** (3)
Fault test generation for combination and sequential circuits, digital simulation as a diagnostic tool, design of easily tested and fault tolerant systems. Physical packaging of digital circuits; design of circuit boards including partitioning, placement, and interconnection of elements. Prerequisite: CSci/EE 153. (Fall—evening) (Friedman)

244 **Data Communications** (3) (Same as EE 347)
Principles and practice of modern data communications. Modes for data transmission; terminals, modems, multiplexors, concentrators. Line control procedures. Protocols for buffer management, message reassembly, queue control. Distributed processing; terminal-oriented systems, data collection loops, multi-drop lines. Switched data systems; circuit and packet switching. Error control, cryptosecurity. Hardware and software interfacing. Prerequisite: EE 243; CSci 201 or permission of course director. (Spring—evening) (Meltzer)

245 **Advanced Computer Systems Theory I** (3)
Analytical models applied to computing systems. Determinance, deadlocks, concurrency, and synchronization of computer processes. Optimal task scheduling using linear graph theory. Concurrent processes in multiprocessors. Analysis of the overlap of I/O and CPU processing. Queuing theory applied to time-shared computer models. Analysis of secondary storage devices and effective data rate. Analysis of memory buffer pools and multiprogrammed memory allocation. Memory allocation and storage heirarchy operation and their effect on throughput and response time. Prerequisite: EE 204; CSci 208, 237. (Fall—evening) (Abd-Alla)

246 **Advanced Computer Systems Theory II** (3)
Optimum secondary storage placement algorithms to improve throughput. Modeling of secondary storage operation and data staging. Analysis of memory allocation algorithms to improve system performance. Characteristics of computer system hardware and software to provide for multiprocessing, multiprogramming, and time-shared operation. Loosely and tightly-coupled multiprocessors. Analysis of front-end processors in data base operation and computer networks. System analysis of a large, time-shared, terminal-oriented transaction processing system. Prerequisite: CSci 245. (Spring—evening) (Abd-Alla)

255 **Analysis and Correctness of Algorithms** (3)
Basic tools of analysis of algorithms. Space and time measures, O(n) and O(f(n)), computer time versus programmer time. Divide-and-conquer, backtracking, branch-and-bound. Lower bounds on computations. NP-hard and NP-complete problems. Correctness, partial correctness, termination, run-time errors. The inductive assertion method, verification conditions and their generation and proof. Applications to algebraic and assembly languages. Prerequisite: CSci 159. (Fall—evening) (Maurer)

256 **Design of Translators** (3)
Design of procedure-oriented computer languages. Semantics and pragmatics as they affect the design of translators, interpreters, and compilers. Top-down and bottom-up recognizers. Production of machine code. Syntax-directed compiling. Tables and their organizations in translators. Optimizing compilers; compiler-compilers. Prerequisite: CSci 159. (Spring—evening) (Maurer)

258 **Advanced Programming Languages** (3)
Recent developments in programming language research. Modern data-structuring concepts such as abstract data structures, access control for reliability, and structuring of data in special-purpose languages. Language extensibility. Machine-independent design of language processors. Case

studies will include Snobol 4, Pascal, and advanced concepts in PL/I. Students' projects will emphasize applications of these languages and concepts. Prerequisite: CSci 159 and permission of course director. (Spring—evening) (Feldman)

263 **Digital Computer Programming Systems** (3)
Design of computer systems software. Design and programming of an assembler and loader. Multiprogrammed job control including linking, loading, linkage-edit, relocatability, region size, and status switching. Design of dispatchers and monitors. Design of utility programs. Input-output programming and control. Communications among components of the operating system. Prerequisite: CSci 159 and 208. (Spring—evening) (Maurer)

267 **Operating Systems I** (3)
Introduction to the operating system for batch-oriented multiprogrammed computer systems. Software components which constitute the operating system. Facilities of the macro-assembler which utilize the operating system; loading and linking routines; initializing programs and tasks; dispatching and the interrupt mechanisms. Memory management in fixed and variable partitions; device and storage management. Input-output control and use of access methods. Performance evaluation. Prerequisite: CSci 208. (Fall—evening) (Hoffman)

268 **Operating Systems II** (3)
Introduction to operating systems for time-shared and multiprocessor computer systems. Processor management in a multiprocessor system; deadlocks, processor utilization, and I/O management. System availability and fail-soft mechanisms. Time-slicing and time-sharing operating systems and subsystems; transaction processing subsystems; memory management in a paged and segmented virtual memory system. Performance of the operating system. Computer network software and an introduction to the computer as a utility. Introduction to security and large data base management. Prerequisite: CSci 267. (Spring—evening) (Hoffman)

278 **Analog and Hybrid Computers** (3)
Analog computer components and electronics. Slow analog computer solutions of linear and nonlinear differential equations. System simulation and modeling on the analog computer. Introduction to the iterative analog computer. Transfer function simulation and use in control theory. The hybrid computer, digital logic, and digital computer control. Digital-to-analog and analog-to-digital converters and interfaces. Optimization methods on a hybrid computer. Parameter variations and searching methods. Prerequisite or concurrent registration: CSci/EE 154; or permission of course director. (Fall, even years—evening) (Bock)

281 **Applications of Numerical Methods I** (3)
Basic numerical methods with emphasis on their application to engineering problems. Error sources and error control; numerical representation of functions; over-determined systems; eigenvalues and eigenvectors; introduction to nonlinear equations; initial value and boundary value problems for ordinary differential equations. Theoretical concepts such as order of accuracy, Richardson's extrapolation, norm, stability, and convergence. Some modern methods such as spline approximation and the QR algorithm for eigenvalues. Prerequisite: CSci 201 or equivalent. (Fall—evening) (Meltzer)

282 **Applications of Numerical Methods II** (3)
A continuation of CSci 281. Systems of nonlinear equations; numerical optimization; numerical solution of common partial differential equations of engineering; methods for hyperbolic, parabolic, and elliptic problems;

introduction to finite element methods. Prerequisite: CSci 281. (Spring, even years—evening) (Meltzer)

285 **Approximation of Functions and Data Representations** (3)
Review of linear spaces; least squares, orthogonal functions; nonlinear techniques, gradient search methods; parameter estimation with discrete data; Tchebysheff approximation; approximation and curve fitting by spline functions and Bernstein polynomials. Prerequisite: CSci 281. (Fall—evening at NASA-Langley Research Center; fall, odd years—evening on campus) (Meltzer)

286 **Numerical Methods in Engineering I** (3)
Computational methods for solution of systems of linear algebraic equations and for the solution of the algebraic eigenvalue problem. Emphasis on accuracy and efficiency. Methods for banded and other sparse systems. Methods for parallel and pipeline processer computers. Prerequisite: CSci 281 and knowledge of linear algebra. (Spring, even years—evening) (Meltzer)

287 **Numerical Methods in Engineering II** (3)
Computational methods for solution of systems of ordinary differential equations: single-step methods, general multistep methods; convergence and stability analysis, methods for stiff equations, step size control and control of order. Prerequisite: CSci 281 and knowledge of differential equations. (Spring, odd years—evening) (Meltzer)

288 **Numerical Methods in Engineering III** (3)
Computational methods for solution of boundary value problems in both ordinary and partial differential equations: shooting methods, finite difference methods, functional approximation methods, invariant imbedding, method of lines, treatment of boundaries in multidimensional problems. Prerequisite: CSci 282 and knowledge of differential equations. (Fall, even years—evening) (Meltzer)

289 **Numerical Methods in Engineering IV** (3)
Computational methods for solution of initial value problems for partial differential equations: method of lines, consistency, stability, convergence; explicit and implicit finite difference methods, alternating direction methods, high-order methods. Prerequisite: CSci 282 and knowledge of partial differential equations. (Spring, odd years—evening) (Meltzer)

298 **Research** (arr.)
Research as arranged. May be repeated for credit. (Fall and spring)

299–300 **Thesis Research** (3–3)
(Fall and spring)

319 **Interactive Computer Graphics II** (3)
Hidden surface algorithms, mathematics and data structures for surface representation, surface texture models, color models, animation, simulation, graphics programming languages, architecture of high-performance hardware, homogeneous coordinates. Prerequisite: CSci 219. (Spring, even years—evening) (Foley)

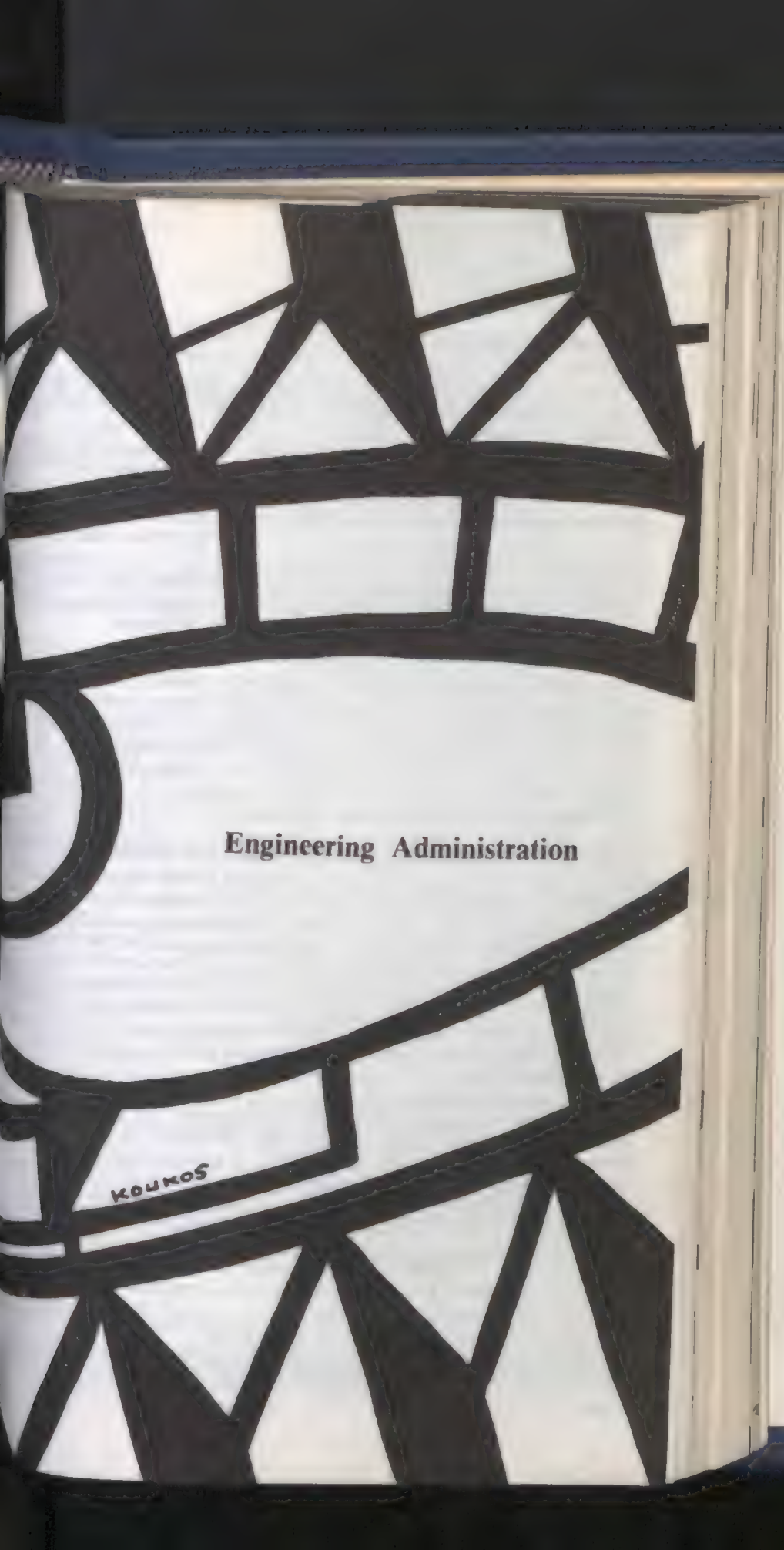
327 **Advanced Topics in Information Systems** (3)
Special topics selected from information systems design: architecture of information systems, organization of large dynamic files, multidimensional search, user interfaces, and data base machines. Students are encouraged to present reports in information systems research. Prerequisites: CSci 159 and one of 215, 216, or 226, or permission of course director. (Fall, odd years—evening) (Berkovich)

391 **Computer Science Research** (arr.)
Limited to students preparing for the Doctor of Science qualifying examination. May be repeated for credit. (Fall and spring)

399 **Dissertation Research** (arr.)
Limited to Doctor of Science candidates. May be repeated for credit. (Fall and spring)







Engineering Administration

Engineering Administration

Professors P.A. Crafton, P.S. Shane, J. Kaye, M. Apstein *(Research)*, S. Rothman *(Chairman)*, H.M. Steiner, R.C. Waters, J.H. Schulman *(Research)*, H.B. Sewell, J.E. Duberg *(Research)*

Professorial Lecturers J.B. Du Peza, C.W. Fotis, D.P. Hearth, R.A. Hemmes, G.T. Malley, J.A. Belding, D.R. Levin, E.S. Hoe, G.W. Leonard

Associate Professors B.G. Silverman, J.F. Dinwiddie

Associate Professorial Lecturers L.H. Blakey, G.M. Hollander, P. Rosenberg, J. Lisnyk, W.A. Goetz, C.A. Kottman, J.R. Margulies, R.J. Lynch, Jr., R. Blanchard, J.T. Solomond, F.W. Shepherd

Assistant Professorial Lecturers T.L. Griswold, S.F. Pauls, F.E. Field, H.S. Kimmel, R. Gurley, R.B. Reynolds, J.L. Pokorney, M.P. Clark, A.M. Biddison, H.M. Thron, C.W. Maus III, W.L. Taylor III, R. Doyon

Graduate Fields and Areas of Concentration

Programs in Engineering Administration lead to the Master of Engineering Administration, Professional, and Doctor of Science degrees. Included are programs in Administration of Research and Development, Construction Management, Environmental and Energy Management, Information Systems Management, Marketing of Technology, Technology and Public Affairs, and Transportation Management. Programs in Systems Analysis and Management lead to the Master of Science, Professional, and Doctor of Science degrees.

MASTER OF ENGINEERING ADMINISTRATION DEGREE PROGRAM

The principal objective of the program leading to the degree of Master of Engineering Administration is to prepare students whose undergraduate education was in engineering, natural science, or mathematics, as reflected by an appropriate degree, for positions of managerial responsibility in technological and scientific organizations in industry, government, or the armed services.

The program consists of a minimum of 24 semester hours of approved graduate courses and a Master's thesis (equivalent to six semester hours). With the approval of the department the student may elect an optional program without a thesis, which consists of a minimum of 33 semester hours of approved graduate courses.

The program is designed to help the student achieve a broad understanding of the administrative process. Although years of experience are required to develop the skills, insight, and mature judgment that distinguish an effective manager in technological and scientific organizations, a graduate professional management curriculum can give the student an effective start as a manager. The curriculum provides an opportunity to gain an understanding and to develop useful managerial skills in the functional areas of engineering administration. One of the major purposes is to assist the student in forming the habit of examining problems from an overall managerial point of view. The individual's own particular experience and the explicit process of relating this experience to graduate study provide each student with a personal frame of reference to interpret management in a rapidly changing world.

Successful education for engineering administration implies an understanding of what it is that an engineering manager must do, an analysis of the

road functions involved in management, and a detailing of modern methods seful in making and executing decisions in the management of technological nd scientific organizations. It is the aim of the Department, therefore, to keep ive a spirit of general inquiry and a decision-making orientation.

The management of technological organizations is one of the most difficult hallenges of our times. The professional engineering manager today must unerstand not only currently developing technologies but also the rapidly changg marketplace where these technologies are applied for society's benefit. The ngineering administrator is the link between these dynamic technologies and the eeds of society in general.

In summary, the program of study has for its objective an educational exerience that will contribute to the development of managers possessing a ombination of technical know-how and administrative skill.

dmission

he principal objective of the program leading to the degree of Master of ngineering Administration is to prepare students whose undergraduate educaon was in engineering, natural science, or mathematics for positions of manerial responsibility in technological and scientific organizations.

In addition to the requirements for admission to graduate study (see pages -29), applicants for programs leading to the degree of Master of Engineering dministration must meet the following requirements: (1) The applicant must ve a basic knowledge of the principles of management, the fundamentals of gineering economic analysis, and the fundamentals of quantitative methods. is requirement can be met by satisfactory completion of EAd 150, 160, and), or approved equivalents. (2) The applicant may be required to complete er undergraduate prerequisite courses prescribed as a condition of admison. (3) A student is required to earn the grade of *C* or better (unless the quirement is stipulated to be a grade of *B* or better upon admission) in each dergraduate prerequisite course. If this scholarship requirement is not met, student is barred from further enrollment. Credit for prerequisite courses ot applicable toward the degree of Master of Engineering Administration d, unless approved by the Department Chairman, all prerequisite courses st be completed prior to taking graduate courses in this degree program.

A student must be accepted in a graduate program in order to receive credit any graduate courses taken to satisfy degree requirements.

e Courses

e following courses are required for the Master of Engineering Administrad degree and are to be taken prior to any other course in the program:
d 211–12 Engineering Administration (3-3)
d 269 Elements of Decision Making and Problem Solving (3)

ral Program

NEERING ADMINISTRATION

dy in engineering administration provides the conceptual depth in manage- practice and knowledge needed by technical and scientific personnel who confronted with increasing demands and complexities. Technical knowledge

is complemented by an understanding of theory and practice in management action. Engineering management is a logical development of a technological society. The program is designed to provide engineers with a knowledge and proficiency in the administration of engineering and science. It emphasizes use of deliberative, purposive study of general administrative problems and opportunities as well as the study and use of specific knowledge and methods needed to solve administrative problems and to explore opportunities. A program is prescribed for each student in conference with the adviser.

Required Courses

EAd core courses (9)
EAd 299–300 Thesis Research (6); or EAd 297 Problems in Engineering Administration (3) (nonthesis option)
Electives (15–21). Electives are chosen from the Department of Engineering Administration and other departments of the University, but no more than two courses may be chosen from other departments.

Areas of Concentration

Students wishing to pursue a specific area of concentration, as opposed to following the general program in EAd, may select one of the following programs:

ADMINISTRATION OF RESEARCH AND DEVELOPMENT

The program is designed to prepare students for responsible managerial positions in organizations conducting technological or scientific research and development and in organizations planning and administering programs of technological or scientific research and development. A program is prescribed for each student in conference with the adviser.

Required Courses

EAd core courses (9)
EAd 207 The Personnel Function for Engineering Administrators (3)
EAd 255 Administration of Research and Development (3)
EAd 299–300 Thesis Research (6); or EAd 297 Problems in Engineering Administration (3) (nonthesis option)
Electives (9–15)

CONSTRUCTION MANAGEMENT

Construction management encompasses managerial functions in an organization that plans and executes major construction work. This can take place in the field, in the project office, or in a main office. Due to the inherent complexity of present-day engineering, engineers need to know management as well as basic planning, design, and construction methods. They need to know construction developments, problems of contracts and specifications, techniques of scheduling and control, estimating, labor relations, and industrial or management psychology.

This program prepares the engineer for the task of marshalling men, materials, machines, and money as functions of time, cost, weather, and human nature to plan and build structures. A program is prescribed for each student in conference with the adviser.

Required Courses

EAd core courses (9)
EAd 241 Construction Management I (3)
EAd 242 Construction Management II (3)
EAd 261 Economic Analysis in Engineering Planning (3)
EAd 299–300 Thesis Research (6); or EAd 297 Problems in Engineering Administration (3) (nonthesis option)
Electives (6–12)

NVIRONMENTAL AND ENERGY MANAGEMENT

his program prepares students for positions in organizations involved with nvironmental, energy, and related resource management. This includes or-anizations conducting environmental control and energy conservation, and rganizations planning and administering programs in energy resource develop-ent/utilization and in prevention and control of environmental pollution. A rogram is prescribed for each student in conference with the adviser.

equired Courses

Ad core courses (9)
Ad 221 Environmental Management (3)
Ad 222 Energy Management (3)
Ad 261 Economic Analysis in Engineering Planning (3)
Ad 299–300 Thesis Research (6); or EAd 297 Problems in Engineering Administration (3) (nonthesis option)
ectives (6–12)

FORMATION SYSTEMS MANAGEMENT

anagers of technological and scientific organizations encounter a variety of anagement information systems required for day-to-day operations and long-nge decisions. This program helps to provide managers with the competence use such systems effectively. A program is prescribed for each student in nference with the adviser.

quired Courses

Ad core courses (9)
Ad 251 Management of Information Processing Resources (3)
Ad 254 Automatic Data Processing Systems (3)
Ad 295 Management of Technical Information (3)
Ad 299–300 Thesis Research (6); or EAd 297 Problems in Engineering Administration (3) (nonthesis option)
ctives (6–12)

RKETING OF TECHNOLOGY

the American economy matures and Americans survey the spectrum of op-ns available to them, it is apparent that scientific and engineering outputs st be sold in worldwide competition both at home and abroad. The trained cialist is becoming more important than ever before in performing the sell-function.

The objective of this program is to prepare students for responsible positions in marketing technical products and services. A program is prescribed for each student in conference with the adviser.

Required Courses

EAd core courses (9)
EAd 293 Technical Enterprises (3)
EAd 294 Marketing of Technology I (3)
EAd 299–300 Thesis Research (6); or EAd 297 Problems in Engineering Administration (3) (nonthesis option)
EAd 311 Marketing of Technology II (3)
Electives (6–12)

TECHNOLOGY AND PUBLIC AFFAIRS

This program prepares students for responsible positions requiring managerial decision making on matters that involve the impact of technology on public policy and that concern the general interrelationship between modern technology and public affairs. A program is prescribed for each student in conference with the adviser.

Required Courses

EAd core courses (9)
EAd 261 Economic Analysis in Engineering Planning (3)
EAd 288 Technology Issue Analysis (3)
EAd 299–300 Thesis Research (6); or EAd 297 Problems in Engineering Administration (3) (nonthesis option)
EAd 386 Advanced Topics in Management (3)
Electives (6–12)

TRANSPORTATION MANAGEMENT

This program prepares students for responsible positions in the management of transportation systems or in the formulation of transportation policy. A program is prescribed for each student in conference with the adviser.

Required Courses

EAd core courses (9)
EAd 261 Economic Analysis in Engineering Planning (3)
EAd 265 Transportation Management I (3)
EAd 266 Transportation Management II (3)
EAd 299–300 Thesis Research (6); or EAd 297 Problems in Engineering Administration (3) (nonthesis option)
Electives (6–12)

ASTER OF SCIENCE DEGREE PROGRAM

ystems Analysis and Management

he Master of Science degree is offered to students specializing in Systems nalysis and Management. The program is administered by the Department of ngineering Administration, with the cooperation of the Department of Opera- ons Research.

The systems viewpoint has been productive in the design of organizations d in detecting, analyzing, and solving organizational problems. It emphasizes e interconnectedness of elements and activities of a system, including per- nnel considerations. An increasing need exists for individuals who can apply e systems approach to organizational systems.

Analysis, synthesis, and management of organizations from the systems andpoint require a blend of studies from the areas of management science d operations research. Study of management science and operations re- arch provides insights into organizations and their personnel, understanding the viewpoints and techniques of managers with whom the system analyst manager must interact, mathematical and statistical tools for the analysis d synthesis of systems, and scientifically based methods for detection, analysis, d solution of system problems. Consequently, a system analyst/manager lizes a mathematical or nonmathematical formulation of information as propriate to the situation. The increasing application of computers for man- ement makes an understanding of their capabilities essential.

MISSION AND PREREQUISITES

addition to the general requirements for admission to graduate study (see ges 28-29), applicants must meet the following requirements: (1) The plicant must have a basic knowledge of probability and statistics, principles management, engineering economic analysis, and computers. The require- nts can be met by satisfactory completion of the following undergraduate rses* or approved equivalents: ApSc 115 and 116; EAd 150, 160; and ci 100. (2) The applicant may be required to complete other undergraduate requisite courses prescribed as a condition for admission. (3) The student equired to earn the grade of *C* or better (unless upon admission the require- nt is stipulated to be a grade of *B* or better) in each undergraduate pre- uisite course. If this scholarship requirement is not met, the student is red from further enrollment. Credit for prerequisite courses is not applicable ard the degree of Master of Science in Systems Analysis and Management, l unless approved by the Department Chairman, all prerequisite courses st be completed prior to taking graduate courses in this degree program.

QUIRED COURSES

ly a nonthesis program is offered

d 211–12 Engineering Administration (3–3)
d 269 Elements of Decision Making and Problem Solving (3)
d 281 Systems Analysis and Management I (3)
d 282 Systems Analysis and Management II (3)

dents may not earn graduate credit for these courses.

EAd 287 Systems Modeling and Simulation (3)
OR 201 Operations Research I (3)
OR 202 Operations Research II (3)

ELECTIVE COURSES

Two courses are to be selected from course offerings of the Department of Operations Research, normally from among the following:

OR 232 Applications of Linear and Nonlinear Optimization Theory (3)
OR 251 Linear Programming (3)
OR 262 Decision Analysis (3)
OR 271 Forecasting Techniques (3)
OR 277 Queuing Theory (3)
OR 279 Inventory Control (3)

One project course is to be selected from the following, according to the nature of the project chosen at the end of the period of study:

EAd 297 Problems in Engineering Administration (3)
OR 291 Problems in Operations Research (3)

PROFESSIONAL DEGREE PROGRAM

The Department of Engineering Administration has established the Professional degree program for those students who are interested in pursuing course work beyond the Master's degree, with emphasis on applied subject material rather than research. The program leads to the degree of Applied Scientist or to the degree of Engineer and has been designed to meet the needs of industry and government for highly prepared personnel in engineering administration.

In the Professional degree program, emphasis is on increasing the student's knowledge, understanding, and skill by concentrating on principles and their application. This approach provides the individual with flexibility to adapt successfully to changing circumstances.

Based on departmental requirements, each student's program is planned considering background and needs.

AREAS OF SPECIALIZATION

The Professional degree program provides post-Master's degree graduate study in areas in which the Department has adequate facilities and resources. Upon departmental approval, the student may select courses in other University departments to meet specific needs or objectives. Courses can, upon departmental approval, be chosen in the following areas:

Administration of Research and Development
Construction Management
Engineering Administration
Environmental and Energy Management
Information Systems Management
Marketing of Technology
Systems Analysis and Management
Technology and Public Affairs
Transportation Management

A student's program of study will provide concentration in a selected area, and include courses from other areas. A program consists of a minimum of 30 semester credit hours of approved graduate courses beyond a Master's degree,

x of which are devoted to a professional project. Students whose prior study oes not include specified prerequisites may be required to take more than the inimum number of credit hours.

DMISSION

dmission to graduate study toward the Professional degree requires appro-iate bachelor's and Master's degrees from recognized institutions, and evi-nce of capacity for productive study. To study toward the Professional de-ee of Engineer (in Engineering Administration), an applicant must possess bachelor's degree in engineering; for the Professional degree of Applied ientist (in Engineering Administration), an applicant must possess a bache-r's degree in mathematics or a natural science. In both cases a Master's gree in engineering administration or a related field is required. Applicants ving equivalent backgrounds of study may be considered. At least a 3.00 average in graduate study is required.

Those applicants having Master's degrees in engineering, natural science, or athematics may be required to meet the following prerequisites: at least the ree core courses (EAd 211–12, 269) and one elective with a grade of *B* better.

Those applicants wishing to pursue study in Systems Analysis and Manage-nt must possess a Master's degree in systems analysis or a related field. Ap-cants having other Master's degrees must have a basic knowledge of prob-lity and statistics, principles of management, engineering economic analysis, computers. These requirements can be met by satisfactory completion of following undergraduate courses* or approved equivalents: ApSc 115, 116; d 150, 160; and CSci 100. The applicant may be required to complete other dergraduate prerequisite courses prescribed as a condition for admission. In dition, several graduate prerequisite courses may be required: EAd 211–12, , 281, and OR 201.

MISSION TO CANDIDACY

applicant is admitted to candidacy for the degree after satisfactorily meet-any prerequisite requirements and conditions. No courses taken by the licant to meet these prerequisite requirements and conditions can be applied ard the Professional degree. If course work beyond the prerequisites and ditions is taken in the interval between admission to study and admission to ree candidacy, a maximum of only 9 hours of this additional course work with the approval of the adviser, be applied toward meeting degree uirements.

NSFER CREDIT

to 6 semester credit hours of satisfactory study (with grades of *A* or *B*) graduate program beyond a Master's degree will be considered for transfer ard the Professional degree. Previously earned credits must have been ed within five years of admission to candidacy for the Professional degree, must be appropriate to satisfy requirements for the Professional degree.

dents may not earn graduate credit for these courses.

The student must, with the approval of the adviser, petition the Department Chairman for such transfer.

PROGRAM OF STUDY

Upon admission, the student is assigned to a faculty adviser. A program of study is drawn up considering any deficiencies at admission and Professional degree requirements. The program of study for each student must be approved by the student's adviser and the Department Chairman. An area of concentration is selected to prepare the student to undertake the professional project. Other courses are selected either to support work on the planned project or to meet other needs. With prior approval of the adviser, up to 9 credit hours of study may be taken in other departments of instruction if such work is pertinent to the program. These 9 hours include the 6 potential transfer credits.

PROFESSIONAL PROJECT

Each degree candidate must engage in a professional project on which the candidate will submit an acceptable report of an analysis and solution of a "real world" problem in engineering administration. The project requires the student to demonstrate the ability to apply newly acquired knowledge to identify a problem, to determine a significant problem, to work toward a solution, and to communicate the results in writing.

When the course work is essentially completed, and with the adviser's approval, the candidate will register for EAd 395–96 *Seminar: Professional Project* (3–3) to receive guidance in the professional project. Before registration the candidate should have identified an area or project to study, and prepared a study proposal, including consideration of the feasibility of the proposed effort. Shortly after registration for work on the project, the candidate must submit a detailed project proposal to the project adviser and to the Department Chairman for approval. Six semester credit hours are assigned for work on the professional project.

SCHOLARSHIP

No student studying for the Professional degree may receive more than two course grades below *B* or more than one *F*. If the student does receive more than two course grades below *B* or more than one *F*, study is terminated and further enrollment is prohibited. A student must achieve a final quality-point average of at least 3.00 *(B)* to receive the degree.

TIME LIMITS

A full-time student in the Professional degree program is allowed a maximum of 3 calendar years from the date of the student's first registration as a graduate student in prerequisite or graduate courses to complete all degree requirements. A part-time student in this program is allowed a maximum of 5 calendar years. The time limit does not include any period of registration as an unclassified student before admission to graduate status, nor does it encompass any specified period spent on approved leave of absence under the conditions and requirements then prevailing.

Students who do not complete degree requirements within the allowed time ll have their graduate status terminated. They may be readmitted to grad- te status under conditions specified by the Department Chairman.

SIDENCE AND CONTINUOUS STUDY

l work for the degree must be done while in residence on campus ex- pt when special permission is granted by the Department Chairman. The dent must maintain continuous enrollment in the School. Failure to do so eaks the student's registration and necessitates application for readmission to e Professional degree program under whatever conditions and regulations e in effect at that time.

CTOR OF SCIENCE DEGREE PROGRAM

ograms in Engineering Administration and in Systems Analysis and Manage- nt leading to the degree of Doctor of Science provide advanced study and earch to enable gifted students to extend their knowledge and to enhance ir career opportunities in research or education.

mission

applicants must meet the general requirements for admission to doctoral dy stated on page 36.

Applicants for doctoral study in Engineering Administration must have a ster's degree, with a superior record of academic achievement in engineer- administration or a related field. Those applicants having Master's degrees engineering, natural science, or mathematics may be required to meet the owing prerequisites: at least the three core courses (EAd 211–12, 269) one elective with a grade of *B* or better.

Those applicants wishing to pursue Systems Analysis and Management must sess a Master's degree in systems analysis or a related field. Applicants ing other Master's degrees must have a basic knowledge of probability and istics, principles of management, engineering economic analysis, and com- ers. The requirements can be met by satisfactory completion of the follow- undergraduate courses* or approved equivalents: ApSc 115, 116; EAd), 160; and CSci 100. The applicant may be required to complete other lergraduate prerequisite courses prescribed as a condition for admission. In ition, several graduate prerequisite courses may be required: EAd 211–12, , 281, and OR 201.

An applicant is admitted to candidacy for the degree after satisfactorily meet- any prerequisite requirements and conditions and after completing *all* se and language requirements and qualifying examinations (see pp. 35–39). courses taken by the student to meet prerequisite requirements and condi- s can be applied toward the Doctoral degree. If course work beyond the requisites and conditions is taken in the interval between admission to study admission to the degree program, a maximum of only nine hours of this tional course work can, with the approval of the adviser, be applied ard meeting degree requirements.

*dents may not earn graduate credit for these courses.

Language Requirement

A doctoral student should maintain a broad outlook in pursuing his or her study and, therefore, must have the capability of reading appropriate literature published in a foreign language. Accordingly, a reading knowledge of one foreign language must be demonstrated before admission to the qualifying examination. The student must obtain approval from his or her doctoral adviser before the language is selected.

Transfer Credit

Up to 6 semester credit hours of satisfactory study, with grades of *A* or *B*, in a graduate degree program beyond a Master's degree will be considered for transfer toward the Doctoral degree. They must have been earned within the five years preceding admission for the Doctoral degree, and must be appropriate to satisfy requirements for the Doctoral degree. The student must, with the approval of the adviser, petition the Department Chairman for such transfer.

Programs of Study

Major fields leading to the degree of Doctor of Science are available in Engineering Administration and in Systems Analysis and Management. In addition to the major field, one or two minor areas of concentration are normally required, which may be chosen from the areas administered by this Department and/or from appropriate areas available in other departments of the University. The general requirements for doctoral study are stated on pages 35–39.

Upon admission, the student is assigned to a faculty adviser. A program of study is drawn up considering any deficiencies at admission, preparation for the Qualifying Examination, and Doctoral degree requirements. The program of study for each student must be approved by the student's adviser and the Department Chairman. An area of study is selected to prepare the student to undertake the dissertation research. Other courses are selected either to support work on the dissertation or to meet other needs.

Dissertation

Each degree candidate is required to prepare and submit a dissertation according to the requirements described on pages 38–39. Once the Qualifying Examinations are satisfactorily completed, the candidate identifies an area or project to study and prepares a research proposal which includes consideration of the feasibility of the proposed research. The detailed project proposal is submitted for approval to the Department Chairman and a selected faculty member who will serve as the student's Director of Research. Work on the research project is conducted as part of the dissertation course EAd 399. The candidate must maintain registration in EAd 399 while the research is conducted.

Scholarship

No student studying for the Doctoral degree may receive more than two course grades below *B* or more than one *F*. If the student does receive more than two course grades below *B* or more than one *F*, study is terminated and further enrollment is prohibited. A student must achieve a cumulative quality-point average of at least 3.2 to receive the degree.

Time Limits

A full-time student in the Doctoral degree program is allowed a maximum of five calendar years to complete all degree requirements, from the date of the student's first registration as a graduate student in prerequisite or graduate courses. A part-time student in this program is allowed a maximum of seven calendar years. The time limit does not include any period of registration as an unclassified student before admission to graduate status, nor does it encompass any specified period spent on approved leave of absence under the conditions and requirements then prevailing (see page 38).

Students who do not complete degree requirements within the allowed time will have their graduate status terminated. They may be readmitted to graduate status under conditions specified by the Department Chairman.

Residence and Continuous Study

All work for the degree must be done while in residence on campus except when special permission is granted by the Department Chairman. The student must maintain continuous enrollment in the School. Failure to do so breaks the student's registration and necessitates application for readmission to the Doctoral degree program under whatever conditions and regulations are in effect at that time.

ENGINEERING ADMINISTRATION UNDERGRADUATE COURSES

150 **Introduction to Engineering Administration** (3)
The interrelationships of engineering, science, and management; conceptual foundations for interaction of human factors in individuals, groups, and the social environment of engineering activities. Familiarization with typical activities of engineering managers and with factors bearing on the motivation of engineers and on engineers as managers. Social and organizational factors relevant to the management of engineers. This course is preliminary to the complete management process studied in EAd 211–12. (Fall, spring, summer)

160 **Introduction to Engineering Economic Analysis** (3)
Economic decisions, equivalence, mathematics of finance, present worth, annual cost or profit, internal rate of return, benefit/cost ratio, incremental analysis, multiple alternatives, economic decisions under risk, inflation, depreciation methods, balance sheets, profit and loss statements, the accountant's view, and before- and after-tax analysis. (Fall, spring, summer)

170 **Basic Quantitative Methods for Engineering Administration** (3)
An introductory treatment of quantitative tools and techniques important in engineering administration. Concepts of probability, statistics, and operations research. (Fall, spring, summer)

ENGINEERING ADMINISTRATION GRADUATE COURSES

204 **Administration of Engineering Contracts** (3)
Study of the total contracting process, including initial budget preparation and justification, actions leading to the execution of a contract, and administration of the contract to completion; considered from the viewpoints of the industrial and government buyer and the seller of technical materials and services. (Fall and spring)

207 The Personnel Function for Engineering Administrators (3)
Principles of managing human talent, the most vital resource in engineering or research; emphasis on principles, theory, and practical considerations of the personnel function for engineering managers, with practical applications in an engineering administration environment. (Fall and spring)

210 Engineering Law (3)
Legal principles and procedures of interest to engineers. The American legal system, contracts and specifications, liability of professional engineers, product liability, agency relationships, patent and proprietary rights, special problems in research and developmental contracts. (Fall and spring)

211–12 Engineering Administration (3–3)
Comprehensive and systematic study of the administrative process; industrial, scientific, and engineering environments. Planning: objectives, prediction, policies, and characteristics of plans. Organizing: theory of organization, structure, authority, specialization, delegation, staff, and committees. Directing: leadership, managing human and material resources. Controlling: setting standards, evaluating performance, using system feedback data for correction and improvement. Prerequisite: EAd 150, 160, or equivalent. (Fall, spring, summer)

214 Patent Law (3)
A comprehensive and systematic introduction to the law of patents, trade secrets, trademarks, and copyright, including the preparation and prosecution of patent applications. Management decisions involving intellectual property rights. The role of the research administrator in preserving and perfecting legal rights in innovations. (Spring)

215 Ethical Issues in Engineering Administration (3)
Moral philosophy from which ethical considerations are derived; ethical issues and exemplary problems encountered in the administration of engineering and allied areas of human endeavor. Use of case study method to enhance student's ability to recognize ethical aspects of problem situations and to think analytically and synthetically about such aspects. (Spring)

221 Environmental Management (3)
The spectrum of technical, economic, political, administrative, and social forces influencing the quality of our environment and the utilization of our resources. Review of governmental and industrial programs to combat pollution of the air, land, and water. Review of existing and pending legislation involving environmental and related energy matters; theoretical aspects of specific management problems; tools for assessing environmental impact; institutional designs; procedures for promoting public participation. (Fall)

222 Energy Management (3)
Designed for those interested in management of energy supply and demand including petroleum, natural gas, coal, nuclear, conservation, and unconventional forms. Topics include energy legislation; theoretical aspects of pricing and scarcity doctrine; instruments for energy policy; hard, soft, and balanced energy paths; social/legal/institutional barriers to new technologies in extraction, processing, and utilization. Attention is given to combating scarcity, using methods that have the least cost and environmental impact. (Spring)

231 Program Management (3)
Programs and projects are widely used in industry and government to facilitate the management of technical undertakings. Management science,

the systems approach, and traditional managerial concepts are applied to a variety of typical cases. (Spring)

241 **Construction Management I** (3)
Types of construction procurement; aspects of contracts and specifications important to project management; subcontracting; project income; insurance; bonds; mechanics' liens. (Fall)

242 **Construction Management II** (3)
Administration of construction projects: planning, scheduling, control, resource allocation, and least cost expediting (CPM and PERT techniques). Labor relations; project safety (OSHA). (Spring)

243 **Construction Management III** (3)
Managerial problems associated with construction; optimal contractor decision making; modeling and systems approach to construction management; the search for projects; selection of projects; bidding strategy. (Fall)

251 **Management of Information Processing Resources** (3)
Advances in information processing technology (including data transmission) affords management many options in acquiring and using a variety of computer-based resources to support organizational objectives. Planning, organizing, acquiring, and controlling these resources are examined. The merits of time sharing, facilities management, in-house computer centers, service bureaus, centralization vs. decentralization, and the relationship to the management structure of the firm are discussed. Prerequisite: EAd 254, or equivalent. (Fall)

253 **Production Management** (3)
Planning, organizing, and control of production; forecasting techniques; material management; methods of loading and scheduling production processes; electronic methods in production control. Organization and administration of the plant engineering function with emphasis on maintenance control programs. (Spring)

254 **Automatic Data Processing Systems** (3)
Logic of computers, hardware and software, systems analysis for data processing applications, systems design, systems economics. Impact on decision making, business, and society. (Spring)

255 **Administration of Research and Development** (3)
The study of technological innovation as a vital part of the organizational adaptation process; the role of the technical manager in using organization, planning, and motivation to accomplish research and development objectives. (Fall and spring)

261 **Economic Analysis in Engineering Planning** (3)
Case studies in engineering economic planning, advanced problems in engineering economy. Prerequisite: EAd 160 or an equivalent course in engineering economy, and permission of instructor. (Fall and spring)

262 **Finance for Engineers** (3)
Exposition of the financial concepts encountered in engineering situations; financial statements, costing, inventories, profitability analysis, depreciation, credit, leasing, and capital formation. (Fall)

265 **Transportation Management I** (3)
Integration of social, technical, economic, and political considerations that shape transportation systems and their management. Course material focuses on modal histories and relative advantages. (Fall)

266 **Transportation Management II** (3)
Course includes intergovernmental relations, regulatory process, property acquisition, cost recovery, condemnation, labor standards, environmental laws applicable to transportation, citizen participation, and land use regu-

lations. Current topics in management and in the legal process in both government and private sectors are highlighted. (Spring)

269 **Elements of Decision Making and Problem Solving** (3)
Concepts and quantitative techniques of scientific method in solving administrative problems. Role of decision criteria and subjective factors. Managerial economics. Model building, testing, solving. Replacement under certainty or risk. Control-general, control charts, sampling inspection. Experimentation to differentiate variables, build models-canons of induction, statistical tests, analysis of variance, linear regression. Application to nonmathematical formulations. (Fall, spring, summer)

281 **Systems Analysis and Management I** (3)
The systems or holistic approach as a methodology for making decisions and allocating resources. Analysis by means of objectives, alternatives, models, criteria, and feedback. (Fall)

282 **Systems Analysis and Management II** (3)
Extension and elaboration of systems analysis techniques, including their application to industry, input-output structures, human behavior in organizations, and military situations. Prerequisite: EAd 281 or permission of instructor. (Spring)

283 **Systems Engineering** (3)
Concept of system structure and organization. Linear and nonlinear systems analysis; dynamics and stability of systems. Introduction to optimization methods and systems simulation techniques. (Fall, odd years)

285 **Seminar: Administrative Problems** (3)
Individual analysis of complex administrative problems, with group evaluation and discussion. Prerequisite: 18 semester hours of graduate credit. (Fall and spring)

287 **Systems Modeling and Simulation** (3)
Introduction to systems modeling and simulation dealing primarily with industrial, organizational, and control models. Emphasis on analyzing the system performance and designing an improved system using analytical or simulation techniques. Prerequisite: EAd 281, 283 or equivalent, and permission of instructor. (Fall, even years)

288 **Technology Issue Analysis** (3)
A seminar for technical managers who need the contextual background and intellectual basis for addressing technology issues in the public and private sectors. Technology impact assessment, technology forecasting, technology innovation, and the principles and practices of technology transfer are treated as elements of a systematic approach to informed choice and sound technology decisions. (Fall)

291 **Structured Analysis of Management Problems** (3)
Application of each phase of a structured problem-solving approach to small-scale management problems. Students will determine problem symptoms; define problems; select a problem; determine constraints on solutions and alternative feasible solutions; develop the solutions, select one, test the solution, plan controls on it, and plan its implementation. Prerequisite: EAd 269. (Spring, even years)

293 **Technical Enterprises** (3)
Essential features of technology-based companies from the entrepreneur's point of view. Team management of an enterprise in a computer-simulated environment. For those within technical firms and those within government who depend on technical firms as suppliers. (Fall)

294 Marketing of Technology I (3)
Marketing industrial goods and high-technology projects: special attention to the federal government as a market. Products, channels, pricing, promotion, and personal selling as elements of strategy. (Spring)

295 Management of Technical Information (3)
Needs and objectives of technical information systems, functions involved in technical information, storage and retrieval, abstracting, computer usage in technical information systems, system organization. Prerequisite: EAd 251 or permission of instructor. (Spring)

297 Problems in Engineering Administration (3)
Project course providing the student with the opportunity to apply the various concepts and tools previously studied to the solution of a problem in engineering administration. Students work individually or in small groups, each on a problem proposed by the student and approved by the instructor. Open to Master's degree candidates in the department. (Fall, spring, summer)

298 Research (arr.)
Basic or applied research in engineering administration or systems analysis. May be repeated for credit. Open to Master's degree candidates in the department. (Fall and spring)

9–300 Thesis Research (3–3)
(Fall and spring)

311 Marketing of Technology II (3)
Special attention to marketing research, negotiation, and international marketing. Required for Master's degree candidates in the Marketing of Technology program. Prerequisite: EAd 294 or permission of instructor. (Fall, even years)

321 Management Information Systems (3)
Study of the development and management of information systems used by middle and higher management of technological and scientific organizations, in the control of many facets of the organization at all managerial levels. Required for Master's degree candidates in the Information Systems Management program. Prerequisite: EAd 295 or permission of instructor. (Fall, even years)

386 Advanced Topics in Management (3)
Reading and discussion of classic and important recent literature concerning the philosophy and application of management principles. (Fall, odd years)

387 Technological Forecasting (3)
Concepts and methodology: normative and exploratory forecasting, resource allocation and forecasting, technology transfer, technological change and its effects on forecasting, technology assessment. (Spring, even years)

388 Cost Effectiveness (3)
Concepts of evaluation of engineered systems, current methods and trends in methodology, system resource requirements, probability and decision theory in cost effectiveness studies, systems approach to cost effectiveness studies. (Spring, even years)

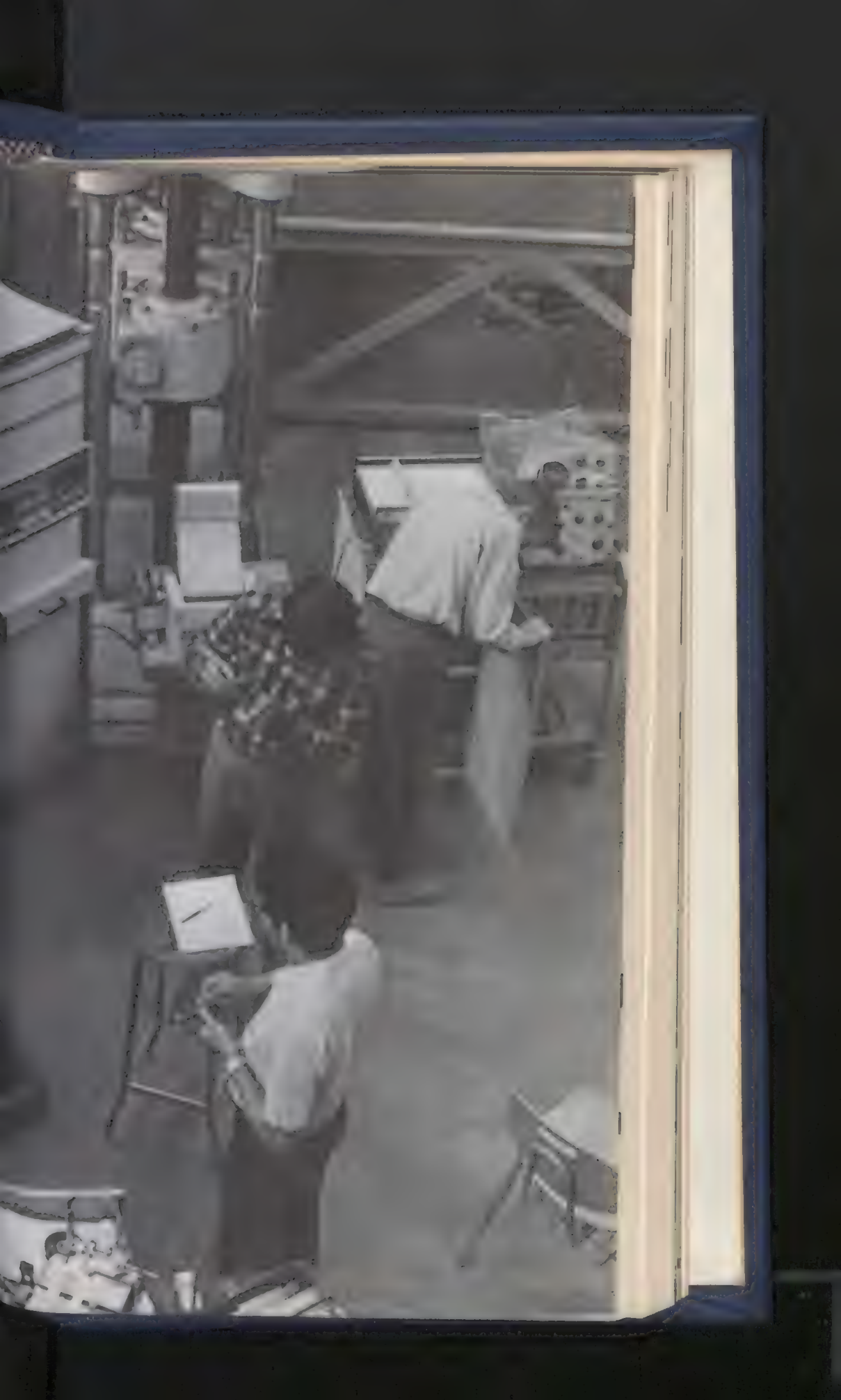
394 Advanced Study (arr.)
Limited to Departmental Professional degree students. May be repeated for credit. (As arranged)

5–96 Seminar: Professional Project (3–3)
Limited to Professional degree candidates in the Department. (Fall and spring)

398 **Advanced Reading and Research** (arr.)
Limited to Doctor of Science candidates. May be repeated for credit. (Fall and spring)

399 **Dissertation Research** (arr.)
Limited to Doctor of Science candidates. May be repeated for credit. (Fall and spring)








Operations
Research

Operations Research

Professors W.H. Marlow, D. Gross *(Chairman)*, N.D. Singpurwalla, A.V. Fiacco, G.P. McCormick, J.E. Falk, R.M. Soland, R.H. Clark *(Research)*
Adjunct Professor F. Frishman
Professorial Lecturers C. Anello, W.R. Nunn, B. Schwartz, S.C. Tignor, J.L. Horowitz, G.R. McNichols, J.W. Blankenship
Associate Professor D.R. Miller
Associate Professorial Lecturers D.R. Edmonds, P.J. Evanovich, K.L. Hoffman, J.F. Ince, J.W. Johnson, H.D. Kahn, B.D. Nussbaum, P.F. McCoy
Assistant Professorial Lecturers J.A. Berning, W.P. Hutzler

Programs in operations research lead to the degrees of Bachelor of Science, Master of Science, Doctor of Science, and to the Professional degree of Applied Scientist.

OPERATIONS RESEARCH AND COMPUTATIONAL SCIENCE PROGRAM—UNDERGRADUATE STUDY

Operations research and computational science is the application of scientific methods and engineering techniques to the solution of management problems, especially where the most efficient and effective use of resources is concerned. Its practitioners seek to observe, understand, and predict the behavior of man-machine systems so that the best decisions about these systems can be made.

Operations research and computational science, as an applied scientific discipline, has a body of specialized methods and theories that are used to design, analyze, and improve operational and managerial systems. It is actually an interdisciplinary field—a synthesis of many disciplines that has evolved into an interesting and exciting field of its own. It combines many of the techniques and theories of engineering, mathematics, computer science, statistics, management, and economics.

In today's complex technological world, those trained in operations research and computational science are increasingly called upon by managers and decision makers to help in the analysis and solution of the many-faceted problems that arise in such diverse areas as transportation, scheduling, distribution, production, inventory control, information systems, manpower planning, health care systems, crime and fire fighting, environmental planning, energy economics, system reliability, forecasting, and strategic planning. It is safe to say that people with such training are now being employed by every major corporation, every major government agency, and every major military command in the United States.

The significant features of operations research and computational science are a broad range of potential applications and a wide variety of scientific techniques that can be selected and combined for a multidisciplinary approach. These characteristics combine to make the profession a dynamic and vital one. Operations research and computational science should be seriously considered by those who are attracted to the use of mathematics, statistics, engineering, and science in solving decision problems of practical significance.

re Curriculum

e first four semesters of work concentrate on the fundamentals of sci-ce and mathematics and also include study in English, the humanities, and social sciences.

During the last four semesters, the student concentrates on the professional urses in operations research, computer science, engineering administration, thematics, and statistics. In addition, an average of one technical elective per nester must be chosen, and the student may choose *sets* of electives that uld allow them to concentrate in areas such as engineering, mathematics, istics, environmental science, management, and so forth, depending on his her special interests:

First Semester

CSci 51:	Applications of Computers (3)
gl 9 or 10:	English Composition: Language as Communication (3)
ath 30–31:	Precalculus and Single-Variable Calculus I (3)
or	
Math 31:	Single-Variable Calculus I (3)
Phys 3:	Foundations of Physics (3)
Elective:	Selected from humanities or social sciences (3)

Second Semester

EngS 4:	Descriptive Geometry and Drafting (3)
Math 32:	Single-Variable Calculus II (3)
Math 33:	Multivariable Calculus (3)
Phys 14:	Introductory Mechanics and Thermal Physics (3)
Elective:	Selected from humanities or social sciences (3)

Third Semester

ApSc 57:	Analytical Mechanics I (2)
ApSc 113:	Engineering Analysis I (3)
Chem 13:	General Chemistry (4)
ApSc 115:	Engineering Analysis III (3)
Phys 15:	Elements of Electricity and Magnetism (3)
Elective:	Selected from humanities or social sciences (3)

Fourth Semester

CSci 52:	Computers and Societal Problems (3)
ApSc 58:	Analytical Mechanics II (3)
pSc 114:	Engineering Analysis II (3)
Math 124:	Introduction to Matrix Theory (3)
Phys 16:	Introduction to Modern Physics (3)
Elective:	Selected from humanities or social sciences (3)

ader students who have not successfully completed a college-level calculus course with a grade or better from an accredited institution, or high school students who did not take an advanced ent (AP) calculus course and receive a score of 4 or 5 on the AP test, will be required to a one-hour locally administered math placement test at registration. This test covers algebra, ometry, and graphs. Students who do not place directly into Math 31 as a result of this test e required to undertake a combined precalculus and calculus course (Math 30–31) during their mester; this combined course meets five hours per week and carries three semester hours of if the student successfully completes the second half (Math 31) of the combined course.

Fifth Semester

OR 101: Survey of Operations Research Methods I* (3)
EAd 150: Introduction to Engineering Administration (3)
ApSc 116: Engineering Analysis IV (3)
CSci 157: Machine and Assembly Language Programming (3)
CSci 158: Algorithmic Methods and High-level Languages (3)
Elective: Selected from humanities or social sciences (3)

Sixth Semester

OR 102: Survey of Operations Research Methods II* (3)
EAd 160: Introduction to Engineering Economic Analysis (3)
CSci 159: Programming and Data Structures (3)
Stat 118: Regression Analysis (3)
Elective: Selected from humanities or social sciences (3)
Elective: *One* technical elective selected from:
Acct 51: Introductory Accounting I (3)
BAd 102: Fundamentals of Management (3)
EE 11: Linear Networks I (3)
ME 126: Fluid Mechanics (3)
ME 131: Thermodynamics (3)
Math 113: Graph Theory (3)
Stat 188: Nonparametric Statistical Inference (3)

Seventh Semester

OR 151: Linear Programming* (3)
Math 139: Advanced Calculus I (3)
Stat 187: Theory of Sampling (3)
Elective: *One* technical elective selected from:
Math 153: An Introduction to Numerical Analysis I (3)
CSci 155: Introduction to Numerical Methods for Computers (3)
Elective: *One* technical elective selected from:
Acct 52: Introductory Accounting II (3)
BAd 141: Basic Marketing Management (3)
EE 12: Linear Networks II (3)
EE 20: Introductory Engineering Electronics (3)
EE 31: Fields and Waves I (3)
ME 176: Environmental Engineering Problems (3)
CE 193: Hydraulics (3)
CSci 151: Introduction to Systems Programming I (3)
CSci 177: Programming for Management Systems (3)
Math 121: Introduction to Abstract Algebra (3)

Eighth Semester

OR 191: Problems in Operations Research* (3)
Math 140: Advanced Calculus II (3)
Stat 117: Analysis of Variance (3)
Electives: *Two* technical electives selected from:
BAd 131: Business Finance (3)
BAd 138: Investment and Portfolio Management (3)
BAd 171: Transportation and Logistics Management (3)
BAd 181: Manufacturing Production (3)

* Undergraduates will register for the 100-level courses but will attend lectures for the corresponding 200-level courses; separate requirements and grading standards will be used.

EE 32:	Fields and Waves II (3)
EE 172:	Control Systems Design (3)
ME 148:	Thermodynamic Analysis (3)
CE 110:	Introduction to Environmental Engineering (3)
CE 194:	Environmental Engineering I: Water Supply and Resources (3)
CSci 156:	Introduction to Systems Programming II (3)
CSci 178:	Introduction to Database Management (3)
Math 122:	Introduction to Abstract Algebra (3)
Math 154:	An Introduction to Numerical Analysis II (3)
Math 157:	Introduction to Complex Variable Theory (3)
Stat 188:	Nonparametric Statistical Inference (3)

Postgraduate Work

Upon completion of the four-year degree program, the student may choose to study one more year and obtain a Master of Science degree in Operations Research. Graduates of the Operations Research and Computational Science curriculum are given two credit hours of advanced standing that are applicable to the master's program.

OPERATIONS RESEARCH UNDERGRADUATE COURSES

101 Survey of Operations Research Methods I (3)
Basic concepts and techniques of operations research as applied to problems in industrial, governmental, and military decision making. Allocation models, including the simplex procedure of linear programming, transportation, and assignment models; queuing theory; inventory theory; game theory; and decision making under uncertainty. Prerequisite: ApSc 115 and Math 33, or equivalent. (Fall and spring)

102 Survey of Operations Research Methods II (3)
Simulation, Monte Carlo techniques; networks; integer programming; introduction to nonlinear programming; dynamic programming; reliability and replacement. Prequisite: OR 101 or permission of instructor. (Fall and spring)

151 Linear Programming (3)
Basic computational, theoretical, and applied areas with emphasis on the general linear programming problems; simplex procedures; duality problems; parametric linear programming and sensitivity analysis; transportation problems. Prerequisite: OR 101 or permission of instructor. (Fall and spring)

191 Problems in Operations Research (3)
Field experience in operations research on a team basis. Each small group locates an actual problem and formulates a solution by operations research models. Class evaluation of progress. Prerequisite: knowledge of FORTRAN or BASIC. (Fall and spring)

199 Honors Research (3)
As arranged.

MASTER OF SCIENCE DEGREE PROGRAM

The objective of the Master's program in operations research is to prepare students with appropriate undergraduate backgrounds for in-depth study of analytically oriented techniques of management decision-making and applications of these techniques.

Expanded scientific, statistical, and mathematical knowledge, combined with growing needs in technological as well as social areas, has created increased demand for individuals trained in operations research. The discipline of operations research uses scientific principles supported by statistical and mathematical methodology to study the function and structure of complex industrial, military, and social systems in an effort to evaluate the probable effects of proposed courses of action, to establish criteria to judge the effectiveness of these courses, and to assist in the making of optimal decisions. The program in operations research provides a scientific basis for solving problems involving the interaction of many factors and organizational components in the interest of the whole system. This breadth of interest is an example of the "systems approach" in the sense that a system is an interconnected complex of functionally related components. Most operations research efforts begin with specific aspects of a general problem and proceed to consideration of the system as a whole. Just as the engineer may start with the study of subsystems or components of a general problem, so may the operations research analyst.

Admission

In addition to the requirements for admission to graduate study (see pages 28–29), the applicant for the program in operations research leading to the Master of Science degree must have an adequate knowledge of probability and statistics. This requirement can be met by satisfactory completion of ApSc 115 and 116, or approved equivalents. It is generally possible to take these courses concurrently with courses taken for graduate credit; however, these undergraduate courses do not fulfill any part of the requirements for the Master's degree.

Required Courses

Core courses required in the field of operations research are OR 201, 202, 209, 210, and 299–300 (for those electing a thesis) or 291 (for those not electing a thesis). Students must complete OR 201, 202, 209, and 210 before attempting any other courses; however, in certain cases permission may be granted for concurrent registration. Students electing OR 291 normally complete this course in the last semester of the program. The remainder of the program is selected, with the approval of the adviser, in an area of concentration from courses in the Department of Operations Research. Appropriate courses from other departments of the University may also be approved as electives.

Areas of Concentration

The goal of the Department of Operations Research is to provide programs flexible enough to accommodate both those students who are interested in applications and those who are interested in theory. Specific areas of concentration and suggested departmental electives follow:

GENERAL OPERATIONS RESEARCH

OR 251:	Linear Programming
OR 252:	Nonlinear Programming I
OR 261:	Theory of Games
OR 275:	Introduction to Scheduling

OR 277: Queuing Theory
OR 279: Inventory Control

With the approval of the adviser, other courses within the Department may be elected.

DEFENSE SCIENCE

OR 237: Logistics Planning
OR 251: Linear Programming
OR 261: Theory of Games
OR 262: Decision Analysis
OR 273: Digital Systems Simulation
OR 281: Reliability Theory I

ENERGY SYSTEMS

OR 251: Linear Programming
OR 252: Nonlinear Programming I
OR 271: Forecasting Techniques
OR 277: Queuing Theory
OR 279: Inventory Control

With the approval of the adviser, courses may be elected from the Department of Civil, Mechanical, and Environmental Engineering.

LOGISTICS ENGINEERING

OR 237: Logistics Planning
OR 251: Linear Programming
OR 253: Integer, Network, and Dynamic Programming
OR 271: Forecasting Techniques
OR 275: Introduction to Scheduling
OR 279: Inventory Control
OR 281: Reliability Theory I

With the approval of the adviser, courses may be elected from the Departments of Economics, Business Administration, Management Science, and Electrical Engineering and Computer Science.

MANAGEMENT SCIENCE

OR 232: Applications of Linear and Nonlinear Optimization Theory
OR 237: Logistics Planning
OR 251: Linear Programming
OR 261: Theory of Games
OR 271: Forecasting Techniques
OR 273: Digital Systems Simulation
OR 275: Introduction to Scheduling
OR 279: Inventory Control

With the approval of the adviser, courses may be elected from the Departments of Business Administration, Economics, Engineering Administration, and Management Science.

MATHEMATICAL MODELING IN INFORMATION SYSTEMS

OR 251: Linear Programming
OR 271: Forecasting Techniques

OR 273: Digital Systems Simulation
OR 275: Introduction to Scheduling
OR 277: Queuing Theory

With the approval of the adviser, courses may be elected from the Departments of Electrical Engineering and Computer Science, Engineering Administration, and Management Science.

MATHEMATICAL OPTIMIZATION

OR 251: Linear Programming
OR 252: Nonlinear Programming I
OR 253: Integer, Network, and Dynamic Programming
OR 261: Theory of Games
OR 275: Introduction to Scheduling

With the approval of the adviser, courses may be elected from applied science offerings and the Department of Mathematics.

MODEL BUILDING FOR TRANSPORTATION FLOWS

OR 231: Theory of Traffic Flow
OR 232: Applications of Linear and Nonlinear Optimization Theory
OR 251: Linear Programming
OR 252: Nonlinear Programming I
OR 273: Digital Systems Simulation
OR 277: Queuing Theory
OR 281: Reliability Theory I

With the approval of the adviser, courses may be elected from the Departments of Civil, Mechanical, and Environmental Engineering; Engineering Administration; and Urban and Regional Planning; and from the National Law Center.

OPERATIONS RESEARCH IN INDUSTRIAL ENGINEERING SYSTEMS

OR 232: Applications of Linear and Nonlinear Optimization Theory
OR 237: Logistics Planning
OR 251: Linear Programming
OR 252: Nonlinear Programming I
OR 271: Forecasting Techniques
OR 273: Digital Systems Simulation
OR 275: Introduction to Scheduling
OR 277: Queuing Theory
OR 279: Inventory Control
OR 281: Reliability Theory I

QUANTITATIVE DECISION-MAKING FOR PUBLIC POLICY

OR 232: Applications of Linear and Nonlinear Optimization Theory
OR 251: Linear Programming
OR 261: Theory of Games
OR 271: Forecasting Techniques
OR 273: Digital Systems Simulation

With the approval of the adviser, courses may be elected from the Departments of Civil, Mechanical, and Environmental Engineering; Economics; Public Administration; and Urban and Regional Planning.

STOCHASTIC MODELING

OR 271: Forecasting Techniques
OR 273: Digital Systems Simulation

OR 277: Queuing Theory
OR 279: Inventory Control
OR 281: Reliability Theory I

With the approval of the adviser, courses may be elected from the Department of Statistics.

PROFESSIONAL DEGREE PROGRAM

This program of advanced study and research leads to the degree of Applied Scientist. The program is designed to provide an educational opportunity for students interested in pursuing post-Master's study with emphasis on applied subject matter rather than on basic research.

Admission

In addition to the general requirements for admission to Professional degree study (see pages 33–34), admission requires an appropriate Master's degree from a recognized institution and evidence of a capacity for productive work as indicated by prior scholarship. The applicant must also possess a bachelor's degree in either engineering, mathematics, or administration. In certain cases, applicants having an equivalent quantitative background may be considered for admission by the Department.

Program of Study and Requirements

The program of study consists of an applied operations research major and an applied out-of-Department minor. A minimum of 30 semester hours is required to earn the Professional degree. This 30-hour minimum includes (a) a minimum of 12 hours in operations research, (b) Stat 201–202, (c) a three-hour professional degree project (OR 391), and (d) a nine-hour applied minor in a field other than operations research. Appropriate minor areas include economics; engineering administration; systems analysis; computer science; systems science, networks and controls; urban and regional planning; transportation systems; environmental engineering; and energy systems.

DOCTOR OF SCIENCE DEGREE PROGRAM

Programs in operations research leading to the degree of Doctor of Science provide advanced study and research to enable students to extend their fields of knowledge and to enhance their career opportunities in research, analysis, management, administration, or education.

Admission

In addition to the general requirements for admission to doctoral study (see page 36), the applicant for the doctoral program in operations research must have a Master's degree, with a superior record of academic achievement. Outstanding professional performance is also considered in evaluating applicants.

Language Requirement

A foreign language is required for the Doctor of Science degree program in operations research. A proficiency in one computer programming language

must be demonstrated before the student is admitted to the doctoral qualifying examination.

Programs of Study

Doctoral programs are planned so that the student may obtain adequate breadth in operations research and sufficient depth in areas of specialization which will enable the completion of a dissertation that will be a significant contribution to the field. Possible areas of study include mathematical programming, multicriteria decision making, inventory, queuing, and reliability. In addition to the major in operations research, two minor areas of concentration are normally required. One minor generally is in applied science, mathematics, or statistics. The second minor may be chosen from within the Department or from appropriate other departments of the University, such as Business Administration; Civil, Mechanical, and Environmental Engineering; Economics; Electrical Engineering and Computer Science; Engineering Administration; Health Care Administration; Management Science; and Urban and Regional Planning. The general requirements for doctoral study are stated on pages 35–39.

PROFESSIONAL FIELDS AND RESEARCH INTERESTS OF OPERATIONS RESEARCH FACULTY

	Areas of Specialization	Areas of Recent Research
Rolf H. Clark	Capital budgeting Feedback modeling Managerial economics Policy analysis	Cost/benefit analysis Cost estimating and analysis Manpower planning Military planning
James E. Falk	Mathematical programming Numerical methods Mathematical modeling	Nonconvex programming Sequential optimization problems Sequential games Application of optimization methods to economics, military, logistics, and location problems
Anthony V. Fiacco	Mathematical programming Numerical methods Mathematical modeling	Penalty function methods Approximation and sensitivity analysis in nonlinear programming Construction and validation of algorithms Nonconvex programming techniques General applications
Donald Gross	Inventory theory Queuing theory Simulation	Queuing approximations Inventory models Applications Risk analysis

W.H. Marlow	Mathematical methods and numerical procedures in operations research and management science	Logistics Systems effectiveness
Garth P. McCormick	Mathematical programming Numerical methods Mathematical modeling	Rate of convergence of algorithms Nonconvex programming Mathematical programming applied to pollution problems and conservation of resources Energy modeling
Douglas R. Miller	Applied probability Stochastic processes Simulation Mathematical statistics	Risk analysis Avionics maintenance models Bounds and approximations for stochastic models Statistical inference using empirical distributions Stochastic models in polymer engineering Algorithms for solving queuing models
Nozer D. Singpurwalla	Applied probability and mathematical statistics Reliability theory and applications Time series analysis and forecasting Fault tree analysis	Applications of time series analysis to reliability problems Bayesian theory and methodology Extreme value theory and applications Nonparametric characterizations of distributions and their testing Models in air pollution and flood discharges
Richard M. Soland	Mathematical modeling Decision theory Mathematical programming	Optimal facility location Interactive multicriteria optimization Multicriteria decision models in the public and private sectors Solution and applications of the generalized assignment problem Risk analysis

OPERATIONS RESEARCH GRADUATE COURSES

201 **Survey of Operations Research Methods I** (3)
Basic concepts and techniques of operations research as applied to prob-

lems in industrial, governmental, and military decision making. Allocation models, including the simplex procedure of linear programming, transportation and assignment models; queuing theory; inventory theory; game theory; and decision-making under uncertainty. Prerequisite: ApSc 115 and Math 33, or equivalent. (Fall and spring)

202 **Survey of Operations Research Methods II** (3)
Simulation, Monte Carlo techniques, networks, integer programming, introduction to nonlinear programming, dynamic programming, reliability and replacement. Prerequisite: OR 201 or permission of instructor. (Fall and spring)

209 **Mathematics in Operations Research I** (3)
Fundamental methods and practical procedures for deterministic decision models in operations research involving a number of variables. Applications of linear models for resource allocations. Applications to data representation and algorithmic procedures for linear and nonlinear optimization models. Applications of linear algebra and real multivariate analysis. Prerequisite: Math 33 or equivalent. (Fall and spring)

210 **Mathematics in Operations Research II** (3)
Fundamental methods and practical procedures for stochastic decision models in operations research involving applications of complex variables. Applications of linear differential, difference, and differential-difference systems to various areas in operations research. Applications of modern numerical methods. Prerequisite: Math 33 or equivalent. (Fall and spring)

231 **Theory of Traffic Flow** (3)
Definitions and measurement of traffic stream parameters, dynamic theories: follow-the-leader models of traffic flow, kinematic theories and fluid analogies, traffic cybernetics, statistical distributions and queuing theory, stochastic approaches to static delay problems, simulation of traffic problems. Prerequisite: ApSc 115 and Math 33, or equivalent. (Spring, odd years)

232 **Applications of Linear and Nonlinear Optimization Theory** (3)
Introduction to penalty-function methods for solving linear and nonlinear optimization problems through use of existing computer codes. Formulation of optimization models in application areas of structural design, nutrition, pollution control, inventory control, energy, economics, psychology, statistics, and chemical processes. Admission by permission of instructor. Prerequisite: Math 33 or equivalent. (Fall)

235 **Analytic Methods for Management and Policy I** (3)
For graduate students in fields other than engineering and operations research. Various quantitative techniques for long-range policy analysis are compared to those useful for shorter term managerial problems. Techniques such as statistics, cost/benefit analysis, cash flows and discounting, mathematical programming, decision analysis, and simulation are presented and viewed in terms of their utility in this management-policy spectrum. The course will orient the student in understanding which techniques naturally apply to the various types of problems a manager policy maker may face. Prerequisite: Stat 51 or equivalent. (As arranged)

236 **Analytic Methods for Management and Policy II** (3)
For graduate students in fields other than engineering and operations research. Whereas OR 235 stresses orientation in the available quantitative methods, OR 236 delves more deeply into the techniques themselves. The first half of the course presents linear and discrete optimization techniques and probabilistic techniques, such as queuing theory, inventory control, and decision theory, and stresses managerial applications. The sec-

ond half presents the theory and application of simulation techniques, including growth theory, system dynamics, and stock flow analysis, and stresses policy applications. Simple case studies illustrating both managerial and policy applications are used. Prerequisite: OR 235. (As arranged)

237 Logistics Planning (3)
Quantitative methods in model building for logistics systems including organization, procurement, transportation, inventory, maintenance, and their interrelationships. Applications stressed Prerequisite: ApSc 115 and Math 33, or equivalent. (Spring, even years)

251 Linear Programming (3)
Basic computational, theoretical, and applied areas with emphasis on the general linear programming problems; simplex procedures; duality problems; parametric linear programming and sensitivity analysis; transportation problems. Prerequisite: OR 201 or permission ot instructor. (Fall and spring)

252 Nonlinear Programming I (3)
Basic topics in optimization theory, including first- and second-order optimality criteria, convexity, duality, and algorithms. Methods for solving unconstrained, linearly constrained, and nonlinearly constrained problems. Applications discussed where appropriate. Prerequisite: OR 202 or permission of instructor. (Spring)

253 Integer, Network, and Dynamic Programming (3)
Methods and applications of optimization problems requiring integral solutions. Cutting plane methods, branch and bound methods, group theoretic methods. Dynamic programming. Network programming: shortest route problems, max flow problems. Prerequisite: OR 202, 251; or permission of instructor. (Fall, even years)

261 Theory of Games (3)
Study of mathematical models with applications to the relationships among independent competitive entities (persons or organizations in environment of competition, bargaining, bidding), selection of optimum strategies, minimax concept, connections with linear programming and decision functions, two-person and n-person zero and nonzero sum games. Prerequisite: OR 201 or permission of instructor. (Fall)

262 Decision Analysis (3)
Study of decision making under certainty and uncertainty, and under one and several criteria. Topics include decision analysis and decision trees, the value of information, subjective probability and Bayesian statistics, utility and value theories, multiple criteria decision making and multiple criteria optimization, goal programming, and group decision making. Some specific applications and practical aspects of decision making will also be treated. Prerequisite: ApSc 116, OR 201, and 202; or permission of instructor. (Spring, odd years)

271 Forecasting Techniques (3)
Introduction to various techniques of forecasting available to an operations research analyst or engineer. Topics include the use of regression analysis in forecasting and other heuristic forecasting techniques. Emphasis on detailed development of the Box-Jenkins technique for time-series analysis, including moving averages and exponential smoothing as special cases. Techniques covered will be applied to engineering, business, and economic situations, using special computer program packages. Prerequisite: ApSc 115, 116; or equivalent. (Fall, odd years)

273 Digital Systems Simulation (3)
Monte Carlo techniques, random number and random deviate generation. Simulation languages. Operating considerations, including model valida-

tion, steady-state, and statistical analyses of simulation output. Applications in inventory, queuing, and production scheduling. Prerequisite: OR 201, 202, or permission of instructor and knowledge of FORTRAN or BASIC. (Spring)

275 Introduction to Scheduling (3)
Theory of scheduling with emphasis on industrial applications, assembly line balancing, sequencing and scheduling of jobs in machine shops. Mathematical optimization, heuristic programming, and computer simulation approaches to these problems are examined. Prerequisite: OR 201, 251; or permission of instructor. (Spring, even years)

277 Queuing Theory (3)
Characterization of queuing systems. Single-channel exponential models. Additional Markovian single- and multiple-channel models, including birth-death processes, finite sources, bulk queues, Erlangian models, and series queues. Models with general arrival and/or service patterns. Model building, basic solution techniques, and formal theoretical developments are stressed. Prerequisite ApSc 116, OR 201; or permission of instructor. (Spring)

279 Inventory Control (3)
Application of mathematical techniques to decisions regarding when and how much to produce or purchase. Various mathematical models of inventory systems with deterministic and stochastic demands, continuous and periodic review policies, multi-item models with constraints. Demand uncertainty and forecasting in inventory models. Prerequisite: OR 201 or permission of instructor. (Fall)

281 Reliability Theory I (3)
Topics introducing the mathematical and statistical theories of reliability. Mathematical theory includes the theory of coherent structures, association of random variables, stochastic characterization of wear, total positivity, preservation theorems, and bounds and inequalities. Statistical theory includes probabilistic derivation of failure models; testing goodness of fit; censored, truncated, and sequential life testing procedures using classical and Bayesian techniques; testing reliability hypotheses and their applications in the commonly used military standard plans. Prerequisite: ApSc 115, 116; or equivalent. (Fall)

291 Problems in Operations Research (3)
Field experience in operations research on a team basis. Each small group locates an actual problem and formulates a solution by operations research models. Class evaluation of progress. Prerequisite: Knowledge of FORTRAN or BASIC. (Fall and spring)

297 Special Topics in Operations Research (3)
Selected topics in operations research, as arranged. Prerequisite: permission of instructor. May be repeated for credit.

298 Research (arr.)
Basic or applied research in operations research. May be repeated for credit. (Fall and spring)

299–300 Thesis Research (3–3)
(Fall and spring)

351 Advanced Topics in Mathematical Programming (3)
Special topics selected from fractional and geometric programming, branch-and-bound methods, max-min problems, pseudo-Boolean programming, calculus of variations, optimal control, penalty function methods, Lagrangian algorithms, fixed point procedures, sensitivity analysis, and large-scale programming. Prerequisite: OR 252 or permission of instructor. (Spring)

352 Nonlinear Programming II (3)
Convex analysis, algorithmic convergence, and rate of convergence. Proofs of optimality conditions. Factorable programming and other problems with special structures. Matrix methods, sensitivity analysis, and nonconvex optimization. Prerequisite: OR 252 or permission of instructor. (Fall)

371 Advanced Topics in Forecasting (3)
Continuation of OR 271 designed for those who wish to develop further capability in this area. Topics include a brief review of OR 271, estimation of parameters of Box-Jenkins models, transfer function models for relating two or more time series, models for intervention analysis, and models for feedforward and feedback control schemes. Also, other techniques and concepts useful in forecasting, such as spectral analysis of time series, including cross-spectral analysis and Fourier analysis. Review and discussion of current literature. Prerequisite: OR 271 or equivalent, or permission of instructor. (Spring, even years)

377 Advanced Stochastic Models in Operations Research (3)
Selected applied probability models, including Brownian motion, renewal theory, denumerable Markov chains, semi-Markov processes, and Markov decision problems. Applications to topics in advanced queuing and inventory theories, including busy periods, waiting times, imbedded Markov chains, and GI/G/1 queues; and conditions for optimality of (s, S) policies, stochastic leadtime problems, state-dependent leadtimes, and multi-echelon problems. Prerequisite: OR 277, 279; or permission of instructor. (Fall)

381 Reliability Theory II (3)
Topics of current interest in the mathematical and statistical theories of reliability. Mathematical theory includes stochastic characterization of multivariate survival, shock models and wear processes, stochastic majorization and its applications, and reliability theory for multi-state components. Statistical theory includes total time on test processes and plots, goodness-of-fit tests using total time on test plots, estimation and forecasting failure rates, and comparison of stochastic processes. Prerequisite: OR 281. (Spring, odd years)

391 Project for Professional Degree (3)
Limited to students in the Professional degree program. (Fall and spring)

397 Advanced Topics in Operations Research (3)
Advanced topics from the literature of operations research for analysis, presentation, and discussion. Reading assignments from professional journals selected by the instructor and the student. May be repeated for credit. Admission by permission of instructor. (Fall and spring)

398 Advanced Reading and Research (arr.)
Limited to students preparing for the Doctor of Science qualifying examination. May be repeated for credit. (Fall and spring)

399 Dissertation Research (arr.)
Limited to Doctor of Science candidates. May be repeated for credit. (Fall and spring)

Required Courses in Engineering Undergraduate Curricula Offered by Columbian College of Arts and Sciences and by the Graduate School of Arts and Sciences

For convenience, descriptions of required courses in undergraduate curricula which are offered by Columbian College of Arts and Sciences and the Graduate School of Arts and Sciences are listed here. See the *Undergraduate and Graduate Bulletin* for elective courses in the humanities and social sciences.

BIOCHEMISTRY

221–22 General Biochemistry (3–4)
A comprehensive course in general biochemistry for graduate students in biomedical sciences and undergraduate students in biology and chemistry. Prerequisite: Chem 152, 154. (Academic year)

BIOLOGICAL SCIENCES

Biology

11–12 Introductory Biology for Science Majors (4–4)
Lecture (3 hours), laboratory (3 hours). BiSc 11: Biological concepts and principles are demonstrated through consideration of the plant as an organism. BiSc 12: Beginning principles of inheritance, development, behavior, physiology, systematics, and evolution, using animals as the subject of investigation; designed to furnish a base for advanced studies in biology and related sciences. Prerequisite to BiSc 12: BiSc 11. Material fee, $24 a semester. (Academic year)

Zoology

145 Introduction to Vertebrate Embryology (4)
Lecture (2 hours), laboratory (4 hours). Origin and early development of the individual, formation of organ systems. Emphasis on frog, chick, and pig, with reference to human embryo. Material fee, $24. (Fall)

148 Histology (4)
Lecture (2 hours), laboratory (4 hours). Introduction to microscopical anatomy of normal tissues and organs with emphasis on the interrelationship of structure and function. Material fee, $24. (Fall and spring)

CHEMISTRY

13 General Chemistry (4)
For engineering and applied science students only. Lecture (3 hours), laboratory (3 hours), recitation (1 hour). Atomic structure, chemical bonding; chemical equations; acids and bases; chemical equilibrium; liquid and solid states; periodicity; electrochemistry; organic chemistry. Prerequisite: Math 31, Phys 14 or 15. Laboratory fee, $35. (Fall)

22 Introductory Quantitative Analysis (4)
Lecture (2 hours), laboratory (6 hours). Theory and practice of quantitative analysis by classical methods; introduction to instrumental analysis. Prerequisite: Chem 12. Laboratory fee, $35. (Fall and spring)

151–52 Organic Chemistry (3–3)
Chemistry of the compounds of carbon. Prerequisite to Chem 151: Chem 12 or 16. Prerequisite to Chem 152: Chem 151. (Academic year)

153–54 Organic Chemistry Laboratory (1–1)
Laboratory complement of Chem 151–52. Prerequisite or concurrent registration: Chem 151–52. Prerequisite to Chem 154: Chem 153. Laboratory fee, $35 a semester. (Academic year)

NGLISH

***9 English Composition: Language as Communication (3)**
Intensive grammar and composition course for students inadequately prepared for Engl 10. Detailed instruction, drill, and exercises in basic structure and writing paragraphs, also includes content covered in Engl 10. Class meets five hours per week. Special fee, $25. (Fall and spring)

***10 English Composition: Language as Communication (3)**
Study and practice of expository techniques; emphasis on the rhetorical complexities of unity, development, organization, and coherence, by analysis of selected current prose; library research procedure. (Fall and spring)

EOLOGY

136 Engineering Geology (3)
For students in the School of Engineering and Applied Science. Geological principles and processes and their application to civil and mechanical engineering. Prerequisite: Math 31, Phys 2 or 4; or permission of instructor. (Spring)

ATHEMATICS

30–31 Precalculus and Single-Variable Calculus I (3)
A one-semester combination of Math 30 *Precalculus* and Math 31 *Single-Variable Calculus I*. The course meets five hours per week and carries three semester hours of credit. After completing the first half of the course (Precalculus), students are examined in precalculus. Students who pass the test continue in Math 30–31. Students who fail the test transfer to a regular Math 30 course for the remainder of the semester. (Fall and spring)

30 Precalculus (3)
Set theory, inequalities, basic analytic geometry, functions and relations. Polynomial, trigonometric, logarithmic, and exponential functions. Prerequisite: Math 3 and 6; or one and one-half years of high school algebra, one year of high school geometry, and one-half year of high school trigonometry; or equivalent. (Fall and spring)

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udents whose College Board English Composition Achievement Test scores suggest inadequate
eation may be assigned to Engl 9 or may be tested in vocabulary, spelling, grammar, stand-
age, and writing skill before placement in either Engl 9 or 10.

ransfer students who have not successfully completed a college-level calculus course with a grade
C or better from an accredited institution, or high school students who did not take an advanced
ement (AP) calculus course and receive a score of 4 or 5 on the AP test, will be required to
a one-hour locally administered math placement test at registration. This test covers algebra,
eometry, and graphs. Students who do not place directly into Math 31 as a result of this test
be required to undertake a combined pre-calculus and calculus course (Math 30–31) during their
semester; this combined course meets five hours per week and carries three semester hours of
it if the student successfully completes the second half (Math 31) of the combined course.

31 Single-Variable Calculus I (3)
Differentiation and integration of algebraic functions, exponentials and logorithms with simple applications. Analytic geometry. Prerequisite: Math 30 or equivalent. (Fall and spring)

32 Single-Variable Calculus II (3)
Calculus of trigonometric functions. Techniques of integration. Indefinite series; vectors; three-dimensional analytic geometry. Prerequisite: Math 31. (Fall and spring)

33 Multivariate Calculus (3)
Vector-valued functions. Partial differention. Multiple integrals. Topics in vector calculus. Prerequisite: Math 32. (Fall and spring)

32–33 Single-Variable Calculus II and Multivariate Calculus (6)
A one-semester combination of Math 32 and 33, meeting five hours per week.

113 Graph Theory (3)
Directed and undirected graphs; bridges, cutpoints, and blocks; connectivity; partitions; Eulerian and Hamiltonian graphs; planarity; coloring problems. Flow charts for computer applications. Prerequisite: Math 32. (Spring)

121–22 Introduction to Abstract Algebra (3–3)
Selected topics in elementary number theory, groups, rings (including polynomial rings), and fields. Open to sophomores with permission of department. Prerequisite: Math 32 or permission of instructor. (Academic year)

124 Introduction to Matrix Theory (3)
Operations on matrices, linear equations, matrix inversion, vector spaces, characteristic roots and vectors. Hamilton-Cayley Theorem. Systems of linear difference and differential equations. Quadratic forms. Applications to economic, biological, and physical models. Prerequisite: Math 32 or permission of instructor. (Fall and spring)

139 Advanced Calculus I (3)
Topology of R^n. Continuous mappings. Uniform convergence. Differentiable mappings. Prerequisite: Math 33. (Fall and spring)

140 Advanced Calculus II (3)
Contraction maps, implicit function and differential equation theorems. Integration theory. Fourier series. Prerequisite: Math 139 or equivalent. (Spring)

153 Introduction to Numerical Analysis (3)
Introduction to fundamentals of numerical analysis using modern digital computers. Solution of linear systems and of ordinary differential equations. Interpolation polynomials. Iterative solution of nonlinear equations. Simple quadrature techniques. Prerequisite: Math 33 or equivalent. (Fall, even years)

154 Difference Equations (3)
Introduction to finite difference equations and their solution. Physical examples and analogies with differential equations are employed to motivate and apply the techniques developed. Generating functions. Analysis of error and stability characteristics. Prerequisite: Math 111 or 139; or equivalent. (Spring, odd years)

157 Introduction to Complex Variable Theory (3)
Analytic functions. Power series. Contour integration and calculus of residues. Conformal mapping. Physical applications. Prerequisite: Math 139. (Spring)

PHYSICS

3 Foundations of Physics (3)
Lecture (2 hours), recitation (1 hour). Development of conceptual principles underlying modern physical knowledge; basics of mechanics, heat and electromagnetism, including the classical concepts of energy, momentum, heat, temperature, entropy, electric and magnetic fields, optics. Prerequisite: two years of college preparatory mathematics or concurrent registration in Math 6. (Fall, spring, summer)

14 Introductory Mechanics and Thermal Physics (3)
Lecture (2 hours), recitation and laboratory (2 hours). Physical principles of mechanics and thermal physics utilizing tools of calculus. Topics emphasized are vector calculus, equilibrium phenomena, kinematics, Newton's Laws, conservation of mass, momentum and energy, rotational motion, small vibrations, thermometry, macroscopic and microscopic properties of ideal gases, the laws of thermodynamics, thermal properties of solids and liquids. Prerequisite: Phys 3 or equivalent, Math 31. Laboratory fee, $18. (Fall, spring, summer)

15 Elements of Electricity and Magnetism (3)
Lecture (2 hours), recitation and laboratory (2 hours). Introductory aspects of electromagnetic theory. Topics include static electric fields, Coulomb's law, Gauss' Law, electric potential, capacitance and dielectrics, electric current and resistance. Ampere's Law, Faraday's Law, Maxwell's equations in integral form, electromagnetic waves. Prerequisite: Phys 3 or equivalent, Math 31. Laboratory fee, $18. (Fall, spring, summer)

16 Introduction to Modern Physics (3)
Lecture (2 hours), recitation and laboratory (2 hours). Elementary approach to basic principles of quantum theory. Topics include wave-particle duality, the hydrogen atom, Pauli's exclusion principle, X-ray spectra, the atomic nucleus, radioactivity, nuclear reactions, statistical distribution laws, application to molecular and solid state physics. Prerequisite: Phys 14, 15, Math 32. Laboratory fee, $18. (Fall, spring, summer)

STATISTICS

117 Analysis of Variance (3)
Lecture (3 hours), laboratory (1 hour). Introduction to the design of experiments and analysis of variance; random block, factorial, Latin square, and analysis of covariance. Prerequisite: Stat 118. Laboratory fee, $18. (Spring)

118 Regression Analysis (3)
Lecture (3 hours), laboratory (1 hour). Regression and correlation theory; simple, partial, and multiple. Prerequisite: 3 semester hours selected from Stat 51, 53, 91. Laboratory fee, $18. (Fall and spring)

159 Principles of Bayesian Statistics (3)
Lecture (3 hours), laboratory (1 hour). Probability as a measure of uncertainty of knowledge; concepts and techniques of Bayesian inference. Prerequisite: three semester hours in introductory statistics, or equivalent. Laboratory fee, $13.

187 Theory of Sampling (3)
Problems of sampling and sample design. Prerequisite: Stat 91 or equivalent. (Fall)

188 Nonparametric Statistical Inference (3)
Statistical inference when the form of the underlying distribution is unspecified. Prerequisite: Stat 91 or equivalent. (Spring)

GENERAL INFORMATION

Registration

The dates, hours, and place of registration will be stated in the *Schedule of Classes,* which is available well in advance of each semester.

New and readmitted students cannot register for classes without having received a letter of admission to the University issued by the appropriate admitting office.

No registration is accepted for less than a semester or less than one summer session.

Students may not register concurrently in this University and another institution without the prior permission of the dean of the college, school, or division in which the student is registered in this University. Registration in more than one college, school, or division of the University requires the written permission of the deans concerned, prior to registration. Allowance of credit for work done concurrently at another institution is at the discretion of the appropriate committee.

ELIGIBILITY FOR REGISTRATION

Registration for the following categories of campus students is held on the days of registration stated in the University Calendar. A student who is suspended or whose record is not clear for any reason is not eligible to register.

New Student—Upon receipt of a letter of admission, the new student is eligible for registration on the stated days of registration.

Readmitted Student—A student previously registered in the University who was not registered for campus courses during the preceding semester or summer session must apply for and receive a letter of readmission from the appropriate admitting office before the student is eligible for registration.

Continuing Student—The student registered for campus courses or having continuous registration status in the immediately preceding semester or the Summer Session preceding the fall semester is eligible to register, assuming good standing and enrollment in a continuing program.

COMPLETION OF REGISTRATION

Registration is not complete until financial settlement is made. Attendance in class is not permitted until registration has been completed.

REGISTRATION CHANGES AND WITHDRAWALS (see pages 214–15, 222)

Registration for Consortium Courses

Degree students interested in taking courses at any of the other institutions in the Consortium of Universities of the Washington Metropolitan Area, Inc. should consult the program announcements of the other institutions. Consortium application forms and instructions may be picked up in the Office of the Registrar after obtaining registration materials. In order to participate in the Consortium program, students must obtain the approval of an adviser and should ascertain from the department of the institution where the course is taught whether they are eligible for the course and whether there is space in the class. Specific inquiries should be addressed to the Registrar.

Fees and Financial Regulations

Fees paid by students cover only a portion of the cost of the operation of the University. Income from endowment funds, grants, and gifts from alumni and friends of the institution makes up the difference.

The following fees and financial regulations were adopted for the 1982 summer sessions and the 1982–83 academic year.

Tuition Fees

For undergraduate study:

Full-time program (12 or more hours per semester)	$2,687.00
Part-time program, for each semester hour	198.00
Summer Sessions, for each semester hour	175.00

For graduate study*

Each semester hour for which the student registers	198.00
Summer Sessions, for each semester hour	175.00

Doctoral students are required to register for minimum hour-loads,† as follows:

1. Full-time doctoral students must register for a minimum of 12 semester hours a semester until 24 hours of work have been completed beyond the qualifying examination; and a minimum of 4 semester hours a semester thereafter until the satisfactory completion of the final examination.

2. Part-time doctoral students must register for a minimum of 6 semester hours a semester until 24 hours of work have been completed beyond the qualifying examination; and for a minimum of 4 semester hours a semester thereafter until the satisfactory completion of the final examination.

*Registration in thesis courses (299-300) entitles the student, during the period of registration, to the advice of the member of the faculty under whom the thesis is to be written. In case a thesis is not finished an additional semester will be granted. If the preparation of the thesis extends beyond the two-semester period, approval for this extension will be required, and the student must repeat the thesis course 300 and pay tuition as for a repeated course, provided the overall time limit for earning the degree is not exceeded.

†No minimum hour-load is required during the summer sessions.

University Center Fee

(Charged all students registered on campus)

For students registered for 11 or more semester hours: Each semester	$60.60
For students registered for less than 11 semester hours: Each semester hour	5.75

Additional Course Fees

In certain courses additional fees, such as laboratory and material fees, are charged as indicated in the course description. These fees are charged by the semester and, unless otherwise indicated, may be defrayed in two payments when the tuition is paid in this manner. Breakage of apparatus is charged against the individual student. When breakage is in excess of the normal amount provided for in the laboratory fee, the individual student will be required to pay such additional charges as are determined by the department concerned.

Graduation Fees

All degrees offered by the School of Engineering and Applied Science	$25.00
Fee for binding Master's thesis	15.00
Fee for microfilm service and printing announcement of final examination for Doctoral degree	75.00

Residence Hall Fees (see page 230).

Special Fees and Deposits

Application fee (undergraduate degree candidates) nonrefundable	$20.00
Application fee (graduate degree candidates), nonrefundable	35.00
Advanced tuition deposit, nonrefundable, charged each entering or readmitted full-time undergraduate student	100.00
Housing deposit, nonrefundable, charged each applicant for residence hall space	200.00
Admission tests (when required)	6.00–12.00
Late-registration fee, for failure to register within the designated period	15.00
Late-payment fee, for failure to make payments when due (see "Payment of Fees" below)	15.00
Financial reinstatement fee, for reinstatement after financial encumbrance for nonpayment of fees (see "Payment of Fees" below)	35.00
Returned check fee, charged a student whose check is improperly drafted, incomplete, or returned by the bank for any reason	15.00
Engineers' Council fee, charged each student in the School of Engineering and Applied Science for each semester or any part thereof except the summer term	5.00
Special Columbian College of Arts and Sciences departmental examination to qualify for receiving credit (advanced standing), waiver of requirement, or both	25.00
	5.00
Waiver examination to qualify for advanced placement	10.00
English test for international students (when required)	
Laboratory checkout fee, for failure to check out of chemistry laboratory by the date deadline set by the instructor*	10.00

* A student who drops a chemistry course before the end of the semester must check out of the laboratory at the next regular laboratory period.

Transcript fee 2.00
If two or more transcripts are requested at the same time, fee for each of the first two copies is $2; fee for each additional copy..... .50
Replacement of lost or stolen picture identification card..... 2.00

Registration for on-campus courses in the University entitles each student to the following University privileges: (1) the services of the Student and Alumni Career Services Office; (2) the use of the University Library; (3) gymnasium privileges; (4) admission to all athletic contests, unless otherwise specified; (5) subscription to the *University Hatchet*, the student newspaper; (6) admission to University debates; (7) medical attention as described under Student Health Service. These privileges terminate when the student withdraws or is dismissed from the University.

PAYMENT OF FEES

No student is permitted to complete registration or attend classes until all charges are paid or until arrangements for payment have been made. Tuition and fees for each semester are due and payable in full at the Office of the Cashier at the time of each registration. Checks and postal money orders should be made out to George Washington University, with the student identification number in the upper left-hand corner.

The Student Accounts Office has responsibility for billing and maintaining student accounts for tuition, various fees, and room and board charges. A student registered for six semester hours or more may sign a deferred payment contract with the Student Accounts Office at the time of each registration permitting payment of one-half of the total tuition and fees (except for fees payable in advance) at the time of registration and the remaining half on or before Wednesday of the eighth week of classes for the fall and spring semesters. Interest at the rate of eight per cent per annum on the unpaid balance will be charged from the date of registration to the date payment is made. A 3-month payment plan is also available.

Students receiving tuition assistance in the form of scholarships, government tuition contracts, or other forms of tuition awards are not permitted to sign deferred payment contracts unless the total tuition and fee charges exceed the value of the tuition awards by $800 or more. Under such circumstances the student may be permitted to pay one-half of the amount due from the student at the time of registration and to defer the balance by signing a deferred payment contract.

Students who fail to make any payment when due will be automatically charged a $15 late-payment fee and will be subject to the interest charge of eight per cent per annum. Accounts which become 30 days past due will be financially encumbered. In the event a student's account is financially encumbered, the student forfeits his right to the use of deferred payment contracts in future semesters, and the Student Accounts Office will notify the Registrar to withhold grades, future registration privileges, transcripts, diplomas, and other academic information until the account is settled financially. Financial settlement will require payment in full of all amounts due the University in addition to a financial reinstatement fee of $35.

Students auditing courses are subject to all fees charged to students registered for credit.

Returned Checks

A student whose check is returned unpaid by the bank for any reason will be charged a returned check fee. If the check is not paid within 15 days, the student will forfeit all rights to check cashing at the University, and future payments for tuition, dormitory, food service, and other special fees will require payment by cash, certified check, or money order.

PREPAID AND DEFERRED PAYMENT PLANS FOR PARENTS

Several commercial programs for parents who wish to pay for college on a monthly basis are available. Terms and conditions vary, but most provide a life insurance policy in the contract. For specific details and applications, address inquiries to the following:

1. Girard Edu-Check Plan, 2nd and Chestnut Streets, Philadelphia, Pa. 19106
2. Richard C. Knight Insured Tuition Payment Plan, 6 St. James Avenue, Boston, Mass. 02100
3. The Tuition Plan, Inc., Concord, N.H. 03301
4. School-Chex, Irving Trust Company, P.O. Box 12231, Church St. Station, New York, N.Y. 10249.

The University's Office of Student Financial Aid does not maintain a supply of applications for these various programs, but will be happy to provide guidance to students and parents.

WITHDRAWALS AND REFUNDS*

Applications for withdrawal from the University or for change in class schedule are made by completing the George Washington University Change Slip (obtainable in Room 103, Tompkins Hall), securing the approval of the appropriate faculty, and submitting the form to Room 103 for the dean's signature. Notification to an instructor is not an acceptable notice (see "Withdrawal," page 222.)

Withdrawal and Change in Course Status

Courses may be dropped by undergraduate and graduate students without academic penalty only during the 28 days following the first day of classes, with the approval of the instructor, the student's adviser, the department, and the dean. The dean's approval may be obtained in Room 103, Tompkins Hall.

The status of a course may not be changed from credit to audit or vice versa after the 28th day after classes have started for the semester.

For other regulations governing withdrawal and changes in program, see page 222.

In authorized withdrawals and changes in schedule, cancellations of semester tuition charges and fees will be made in accordance with the following schedule for the fall and spring semesters:

1. *Complete withdrawal* from the University:
   Withdrawal dated on or before Saturday of the *first* week of classes....90%

*Regulations concerning withdrawals and refunds for the Summer Sessions are stated in the *Summer Sessions Schedule of Classes.*

Withdrawal dated on or before Saturday of the *third* week of classes....75%
Withdrawal dated on or before Saturday of the *fifth* week of classes....50%
Withdrawal dated after the fifth week of classes .....none

2. For a *change in status from full-time to part-time student* or for *partial withdrawal by a part-time student*, the above schedule applies to the difference between charges for the original program and the adjusted charges for the revised program.
3. A student enrolled in an undergraduate full-time program who drops or adds a course and continues to be in a full-time program will have no financial adjustments of tuition made other than those involving course fees.
4. A student who is granted leave before completing the semester will receive credits for current charges in accordance with the schedule for complete withdrawal from the University (see No. 1, above). Payments made in excess of the nonrefundable balance will be refunded to the student.
5. Regulations governing student withdrawals as they relate to residence hall and food service charges are contained in the specific lease arrangements.
6. Refund policies of the University are in conformity with guidelines for refunds as adopted by the American Council on Education.
7. In no case will tuition be refunded or reduced because of absence from classes.
8. Authorization to withdraw and certification for work done will not be given a student who does not have a clear financial record.
9. Students are encouraged to provide their own cash funds until they can make banking arrangements in the community.

Financial Aid*

FOR UNDERGRADUATE STUDENTS

George Washington University offers a program of financial assistance of two basic types: awards for academic achievement without reference to financial circumstances—honor scholarships; and scholarships, grants, loans, and employment based upon demonstrated financial need. Applicants may apply for only *one* type of aid: need-based or honor.

Engineering Honors Scholarships (EHS)—Academic Merit Only

This program was initiated to recognize academically talented students who wish to study at the School of Engineering and Applied Science. The scholarships are awarded on the basis of merit only and "financial need" is not a requirement for consideration. Applicants with financial need should apply for need-based aid, *not* for EHS. The EHS is available to entering freshmen and transfer students who have (or will have by the time of entrance to SEAS) completed 30 credit hours of college-level work which includes 6 credit hours of calculus or higher math and 3 credits of either physics or chemistry. These scholarships cover one-half the tuition costs of attending SEAS and may be awarded to qualified students for up to four years, as long as scholar-

* For information concerning financial aid for students from foreign countries, see page 220.

ship criteria are met with the option of a fifth year if the student wishes to obtain a Master's degree.

MINIMUM CRITERIA FOR INCOMING FRESHMAN

The minimum criteria in the EHS Program will be based on merit in which the student has:

1. achieved a minimum combined SAT score of 1250 or better; or an average ACT score of 28 or better in the English/mathematics/natural science tests; and ranked in the upper 10% of the class over 3 years or more;

   or

   achieved a minimum combined PSAT score of 125 or better;
2. ranked at the end of the junior year in the upper 10% of the class over a period of 3 years or more;
3. achieved an average grade of 85%, or better, at the end of the junior year, in mathematics and science courses taken during the previous 3 years.

MINIMUM CRITERIA FOR INCOMING TRANSFER STUDENTS

The minimum criteria in the EHS Program will be based on merit in which the student has:

1. completed (or will have completed at the end of the present semester) 30 credit hours in an accredited community college, college, or university;
2. completed courses which must include at least 6 credit hours of college calculus or higher mathematics and at least 3 additional hours of college level physics or chemistry;
3. achieved an overall quality point index of at least 85% (3.4) and a combined average of 80% (3.2) in the mathematics and science courses.

Need-Based Financial Aid

The University offers extensive programs of scholarships, grants, loans, and employment based upon demonstrated need. The University participates in the National Direct Student Loan, Basic Educational Opportunity Grant, Supplemental Educational Opportunity Grant, and the College Work-Study programs.

Applications and supporting credentials for financial aid other than Engineering Honors Scholarships must be filed by February 1 (entering freshmen) or March 1 (enrolled undergraduate or entering transfer students) preceding the academic year of the award for the fall semester; by November 1 for the spring semester; and by April 1 for the summer sessions.* *A student must reapply for financial aid each year.*

Application deadlines for Engineering Honors Scholarships vary according to the category of student. Applicants with financial need should apply for need-based aid, *not* for EHS.

Scholarships and Grants

Scholarships are awarded for the academic year unless otherwise specified and are credited in equal parts for each semester. *Each holder must carry at least*

* Summer Sessions students are eligible for consideration only if they were enrolled in this University for at least 8 semester hours in the immediately preceding spring semester or have applied for financial aid for the following fall semester.

15 credit hours per semester in subjects related to the degree program during the period for which the scholarship is awarded. Most of the following scholarships are limited to students in the School of Engineering and Applied Science. The University also offers other scholarships which are open to engineering students.

Frederick Albert and Alma Hand Britten Scholarships (1959)—Bequest of Alma Hand Britten for scholarship assistance to students entering the School of Engineering and Applied Science who would not otherwise be able to pursue such professional study. Available for undergraduate and graduate study.

American Association of Cost Engineers Scholarship (1977)—Established by American Association of Cost Engineers for scholarship assistance to a full-time student, graduate or undergraduate, majoring in a curriculum which includes courses related to cost engineering.

Atlantic Research Corporation Scholarship (1979)—Established by the Atlantic Research Corporation for both graduate and undergraduate students. The scholarship for undergraduates includes full tuition, books, and fees for students in their senior year only. Graduate students receive full tuition, books, and fees for one year of full-time graduate work. Recipients of the award must have an overall *B* average and must agree to accept employment with Atlantic Research Corporation for one year after graduation. Awards are offered both on a financial-need and a non-financial-need basis. See Manager of Engineering Admissions for further details.

Henry Harding Carter Scholarship (1896)—Established by Maria M. Carter in memory of her husband to aid a deserving student who is preparing for the civil engineering profession. Available to students working toward the degree of Bachelor of Science (Civil Engineering).

Henry Parsons Erwin Scholarship (1955)—Established by Helen B. Erwin as a memorial to her husband, a former Trustee of the University. A partial scholarship for a student in Engineering and Applied Science.

Louis E. Giles Memorial Scholarships (1966)—Bequest of Susie E. Giles in honor and memory of her husband for scholarships to undergraduate and graduate students in the School of Engineering and Applied Science requiring financial assistance.

The George Hyman Construction Company Scholarships (1974)—Established by the George Hyman Construction Company to aid deserving students preparing for the civil engineering profession. These partial tuition undergraduate scholarships begin in the fall semester and extend for four years, provided the holder maintains a *B* average based upon a full course load leading to a degree in civil engineering and continues to be in financial need.

National Fund for Minority Engineering Students Scholarship (1977)—Scholarship for minority students who require financial assistance of up to $4,000 and are in good academic standing. Minority students are defined as full-time students of black, Puerto Rican, American Indian or Chicano descent, who are U.S. citizens or permanent residents, and who are entering an engineering school or university for the first time.

George Washington University Board of Trustees Scholarships—Full and partial tuition undergraduate scholarships which begin in the fall semester and extend for four successive academic years, provided the holder maintains a *B* average, and continues to be in financial need. Candidates must plan to select a curriculum leading to a Bachelor's degree.

FOR GRADUATE STUDENTS

Scholarships, Fellowships, Assistantships

The George Washington University program of financial assistance for graduate students includes assistantships, fellowships, traineeships, graduate scholarships, research appointments, part-time employment, and loans. Application for admission to graduate study is a prerequisite for consideration.

Application and correspondence concerning assistantships, fellowships, traineeships, or graduate scholarships should be sent directly to the department concerned and addressed to George Washington University, Washington, D.C. 20052. Unless otherwise specified, the application and supporting credentials should be submitted not later than February 1 preceding the academic year for which the award is made.

Frederick Albert and Alma Hand Britten Scholarships (1959)—See p. 217.

American Association of Cost Engineers Scholarship (1977)—See p. 217.

Louis E. Giles Memorial Scholarships (1966)—See p. 217.

Phi Delta Gamma Scholarship Endowment Fund (1968)—Established by the Beta Chapter of Phi Delta Gamma, national fraternity for graduate women. For graduate women students.

National Science Foundation Graduate Fellowships—Fellowships leading to graduate degrees in the mathematical, physical, medical, biological, engineering, and social sciences, and in the history and philosophy of science; providing tuition, fees, and stipends. Open to students who have been admitted to graduate status and who have completed less than one calendar year of graduate study. Applications should be made to the Fellowship Office, National Research Council, 2101 Constitution Avenue, N.W., Washington, D.C. 20418.

Research Assistantships in Operations Research and Related Fields—Available to graduates, and to undergraduates on the junior and senior levels, in any school of the University. Research Assistants are expected to work 20 hours a week conducting research in support of an established research program or in programming or in conducting individual research on an approved research project. Stipends range up to $10,100, depending on the status of the student and the tenure of the appointment (9–12 months). Application deadline is March 1. Further information and applications are available from Director, Institute for Management Science and Engineering, School of Engineering and Applied Science, George Washington University, Washington, D.C. 20052.

Research Assistantships in Engineering Administration—Available to graduates in any Engineering Administration program. Research Assistants are expected to work 20 hours a week conducting research in support of an established research program. Stipends range up to $8,500 depending on the status of the student and the tenure of the appointment (9–12 months). Further information and applications are available from the Chairman, Department of Engineering Administration.

Research Scholar Assistantships, GWU/NASA-Langley Program—See pages 42–44.

Resident Assistantships (men and women)—Available to graduate students and seniors in any field of study who are interested in working with the student personnel program in University residence halls. Specific duties vary with the

position, but basically consist of counseling, advising student groups, and administration. Remuneration includes partial tuition and a furnished room for the academic year. All positions are part-time, and staff members are required to enroll as full-time students in degree granting programs. Further information may be obtained from the Office of the Director of Housing.

SPONSORED AWARDS FOR GRADUATE STUDY

Information regarding awards sponsored by foundations, professional and learned societies, industries, and others which may be used in support of graduate study is available at the Graduate Fellowship Information Center, 2025 H St., N.W., for students enrolled at George Washington University. Information is also available on distinguished programs such as the Rhodes, Marshall, National Science Foundation, Fulbright, Rotary International, and Danforth as well as many others.

Since deadlines for application vary, qualified students should make inquiries well in advance of the year of planned graduate study.

LOAN FUNDS

Several loan funds are available to students in the University in accordance with the qualifications specified by the donors. Two loan programs limited to students in the School of Engineering and Applied Science are available. Students should direct inquiries to and file applications with the Office of Student Financial Aid. Applications for the National Direct Student Loan should be filed no later than April 1 for the following academic year. Complete information is contained in the pamphlet, "On the Trail of Student Financial Aid," available in the Office of Student Financial Aid, George Washington University, Washington, D.C. 20052.

Warren Stickler Memorial Loan Fund (1966)—A fund established by the Precision Measurements Association as a memorial to Warren Stickler is available to engineering students.

John Brewster Willis, Jr., Loan Fund in Mechanical Engineering—Established by Mrs. William L. Lane as a memorial to her nephew, John Brewster Willis, Jr. Available to Mechanical Engineering students (graduate or undergraduate) who are primarily interested in aeronautics.

Two short-term emergency loan funds are also available at the University. Information concerning these funds is available from the Office of Student Financial Aid.

STUDENT EMPLOYMENT

The University participates in the College Work-Study Program. Inquiries should be addressed to the Office of Student Financial Aid. In addition, the Student and Alumni Career Services Office maintains a registry of both full-time and part-time positions available in the Washington area for undergraduate and graduate students.

After registration, students may apply at the Student and Alumni Career Services Office, Woodhull House, 2033 G Street, N.W., for interviews and referrals to positions for which they are qualified.

INTERNATIONAL STUDENTS

Undergraduate international students with proven financial need, but with no prior schooling in the United States, who have completed one semester of full-time work (15 hours) at this University with a *B* average are eligible to apply for the Board of Trustees Scholarships. If before coming to this University, they have completed at least one year in a U.S. high school and have taken SAT or ACT tests, they may apply for financial assistance upon admittance. Scholarships are awarded in the spring for the following academic year. See instructions for applying for undergraduate financial aid, pages 215–16.

Limited awards for graduate teaching assistantships and University fellowships are the responsibility of the chairman of the department or dean of the school in which the degree is to be earned. Work as a teaching fellow requires excellent knowledge of English—both spoken and written.

Long-term loan funds for undergraduate and graduate international students are limited in amount and are generally available only to those foreign-born persons who have established resident status in the United States through the Immigration and Naturalization Service.

Students who wish to study in the United States should have available sufficient funds to cover expenses for one full year before attempting to enter a college or university. The cost at this University for one academic year (September-May) is at a minimum approximately $8,600. This estimate includes room and board, tuition, books, clothes, and incidental expenses: no travel, holiday, or medical expenses are included. This amount does not cover tuition or living expenses for the summer.

Prizes

Norman B. Ames Memorial Award—Established by many friends of Professor Ames and awarded annually to a graduating senior of the School of Engineering and Applied Science who is nominated by his fellow students as having made significant contributions to the students in the School of Engineering and Applied Science, to the School, and to the University.

Deacon Ames Activities Award—A plaque awarded annually by Gamma Beta Chapter of Theta Tau Fraternity to the senior in the School of Engineering and Applied Science with the most outstanding record in activities for the entire period of attendance.

Martin Mahler Prize in Materials Testing—A one-year membership in the American Society for Testing Materials awarded to the upper division or graduate student in engineering who submits the best reports on tests in the materials laboratories course with preference given to prestressed concrete tests.

Alfred Martin Freudenthal Prize—Established as a memorial to Professor Freudenthal by his wife, friends, students, and colleagues for his outstanding contributions to engineering education. This honor for academic excellence is awarded annually to the senior who graduates with the highest scholastic standing. The student will receive a cash award, and his/her name will be engraved on a plaque displayed in Tompkins Hall.

Regulations

A student enrolled in the School of Engineering and Applied Science is required to conform to the following regulations.

A student who withdraws or is suspended or who, for any other reason, is not registered at the University for one semester or more, may re-enter and continue work only under the regulations and requirements in force at the time of return.

If a student knowingly makes a false statement or conceals material information on an application for admission, registration card, or any other University document, the student's registration may be canceled. If such falsification is discovered after the student has established an academic record at the University, the student may be subject to dismissal from the University. Such a student will be ineligible for subsequent registration in the University except by special action of the Faculty.

ACADEMIC DISHONESTY

The University community, in order to fulfill its purposes, must establish and maintain guidelines of academic behavior. All members of the community are expected to exhibit honesty and competence in their academic work. Incoming students have a special responsibility to acquaint themselves with, and make use of, all proper procedures for doing research, writing papers, and taking examinations.

Members of the community will be presumed to be familiar with the proper academic procedures and held responsible for applying them. Deliberate failure to act in accordance with such procedures will be considered academic dishonesty. Acts of academic dishonesty are a legal, moral, and intellectual offense against the community and will be prosecuted through the proper University channels.

Copies of the University Policy on Academic Dishonesty can be obtained from the following officers: all department chairmen, all academic deans, and the Vice President for Academic Affairs.

STUDENT CONDUCT

All students upon enrolling and while attending The George Washington University are subject to the provisions of the *Statement of Student Rights and Responsibilities* which outlines student freedoms and responsibilities of conduct, the Judicial System for Non-Academic Student Discipline, and other policies and regulations as adopted and promulgated by appropriate University authorities. Copies of these documents may be obtained at the Office of the Vice President for Student Affairs. Sanctions for violation of these regulations may include permanent expulsion from the University which may make enrollment in another college or university difficult. Regulations or requirements applicable only to a particular program, facility or class of students may not be published generally, but such regulations or requirements shall be published in a manner reasonably calculated to inform affected students.

CHANGES IN PROGRAM OF STUDY

A student may not make any changes in an approved program of study without the approval of the faculty adviser and the Associate Dean. Requests for changes in class registration must be made on a form provided in the School's Admission office.

During the 14 days following the first day of classes of a semester, courses may be added to the student's program with the approval of the instructor, the faculty adviser, and the Associate Dean.

WITHDRAWAL

A student who withdraws or is otherwise absent from the University for one semester or more must apply for readmission. If readmitted, the student continues work under the requirements and regulations in force at the time of readmission.

Applications for withdrawal from the University or for changes in class scheduling must be made in person or in writing to the individuals indicated below. Notification to an instructor is not an acceptable notice.

Regular Withdrawal—Courses may be dropped by undergraduate and graduate students without academic penalty only during the 28 days following the first day of classes, with the approval of the instructor, the student's adviser, the department, and the Associate Dean.

Late Withdrawal—Withdrawal from any course without academic penalty after the 28th day following the first day of classes of a semester may be granted with the approval of the instructor, the student's adviser, the chairman of the department in which the student is enrolled, and the Associate Dean. Requests for late withdrawal must be submitted to the Associate Dean's office on the appropriate late-drop form and must be accompanied by a change slip. Late withdrawals may be granted only under both of the following conditions:

1. The request is made necessary by exceptional circumstances such as certified medical absence or forced absence caused by work-related requirements
2. The grades in all courses involved are *C* or better for graduate students, and *D* or better for undergraduate students as of the date of the request.

In all cases, financial regulations governing withdrawal remain in full effect.

Change in Course Status—The status of a course may not be changed from credit to audit or vice versa after the 28th day after classes have started for the semester.

Full tuition is charged for courses dropped without the approval of the Associate Dean. Such unauthorized withdrawal will result in the recording of a failing grade for the course or courses. Permission to withdraw from the University will not be granted to a student who does not have a clear financial record.

CREDIT

Credit is given only after registration for a course and satisfactory completion of the required work, or upon the granting of advanced standing.

Auditing—A person who has been admitted to the University may be registered, with the permission of the instructor, as an auditor in a class (no academic credit). An auditor is not required to take active part or to pass examina-

tions. A student who takes a course as an auditor may not repeat it later for credit.

Balance Sheet—On request the Registrar will issue to undergraduate degree candidates a balance sheet showing the amount of work completed and the requirements remaining to be met for the degree. A second balance sheet is issued only if the student changes major or degree objectives.

Post-admission Transfer Credit—A student who plans to attend another institution and apply credit so earned toward graduation from this University must first secure the written approval of the adviser, the Department Chairman, and the Associate Dean, on a form available in room 103, Tompkins Hall. In no event will credit in excess of what might be earned in a similar period in this University be recognized.

TRANSCRIPTS OF RECORD

Official transcripts of student records are issued on written request of the student or former student who has paid all charges, including any student loan installments, due the University at the time of the request. A fee of $2 is charged for each transcript. When more than two transcripts are ordered at the same time, a $2 fee is charged for each of the first two transcripts and a $.50 fee is charged for each additional transcript. Partial transcripts are not issued.

GRADUATION REQUIREMENTS

To be recommended by the faculty for graduation, a student must have met the admission requirements of the School; completed satisfactorily the scholarship, curriculum, residence, and other requirements for the degree for which the student is registered; and be free from all indebtedness to the University. Registration is required for the semester or summer session at the close of which the degree is to be conferred.

Application for Graduation—An "Application for Graduation" form must be filed and the appropriate fee paid at the time of registration for the last semester or summer session of the senior or final year. Students completing degree requirements during the summer sessions will be awarded diplomas (no formal convocation) dated September 30, provided they have completed all degree requirements and have applied for graduation as a part of registration for the summer sessions.

Attendance and Conduct—The University reserves the right to refuse to confer a degree upon a candidate whose attendance or conduct has been unsatisfactory.

Student Records—Information on the status of credit, transfer-of-credit cards, balance sheets, and other information relating to graduation may be obtained in Room 103, Tompkins Hall.

Area of Concentration Certificate—Upon successful completion of the Master's degree the student, by means of a written request to the appropriate Department Chairman, may obtain a certificate indicating the area of concentration.

THE LIBRARY

All students registered in the University have the privilege of using the University Library. Its stacks are open, and all students are welcome to browse.

A card denoting approved enrollment for the current semester must be presented when books are borrowed for outside use.

The loan period for stack books is 14 days. Any book which circulates is subject to recall by the library if needed for reserve or other use. Reserve books must be used in the reserve reading room when the library is open, except that they may be withdrawn for overnight use beginning at 8:30 p.m. Transcripts of grades are withheld until a student's library record is clear, with all borrowed books returned and any fines paid.

All students using the University Library are expected to be familiar with its detailed regulations, available at any of the library's service desks.

UNIVERSITY POLICY ON THE RELEASE OF STUDENT INFORMATION

The Family Educational Rights and Privacy Act of 1974 applies to institutional policies governing access to and release of student education records maintained by educational institutions which are recipients of federal funds. The University complies with this statute, which states, in part, that such institutions must:

1. Afford students access to education records directly related to them;
2. Offer students an opportunity for a hearing to challenge such records as inaccurate, misleading, or otherwise inappropriate;
3. Receive the student's written consent before releasing information from his or her education records to persons outside the University, except as provided by the Act and except for directory information as indicated below. Information may be furnished to a student's parents without such written consent only upon certification of the student's financial dependency; and
4. Comply with a judicial order or a lawfully issued subpoena to release a student's record, notifying the student of such action.

The University will release the following directory information upon request: name, local address; telephone number; name and address of next of kin; dates of attendance; school, college, or division of enrollment; field of study; credit hours earned; degrees earned; honors received; participation in organizations and activities chartered or otherwise established by the University (including intercollegiate athletics); and height and weight of members of athletic teams. A student who does not wish such directory information released must file written notice to this effect in the Office of the Registrar.

Copies of the University's full policy statement on the release of student information may be obtained from the Office of the Registrar.

RIGHT TO DISMISS STUDENTS

The right is reserved by the University to dismiss or exclude any student from the University, or from any class or classes, whenever, in the interest of the student or the University, the University Administration deems it advisable.

RIGHT TO CHANGE RULES

The University and its various colleges, schools, and divisions reserve the right to modify or change requirements, rules, and fees. Such regulations shall go into force whenever the proper authorities may determine.

RIGHT TO MAKE CHANGES IN PROGRAMS

The right is reserved by the University to make changes in programs without notice whenever circumstances warrant such changes.

PROPERTY RESPONSIBILITY

The University is not responsible for the loss of personal property. A Lost and Found Office is located on campus in the Safety and Security Office.

UNIVERSITY POLICY ON DRUGS

The University cannot condone violations of law, including violations of those laws which proscribe possession, use, sale, or distribution of drugs. Members of the academic community should know that administrative action, which may include dismissal from the residence halls, revocation of other privileges, or suspension or dismissal from the University, may be taken in order to protect the interests of the University and the rights of others.

Consortium of Universities of the Washington Metropolitan Area, Inc.

The universities in Washington, D.C. (American University, Catholic University of America, George Washington University, Georgetown University, Howard University, and the University of the District of Columbia) are associated in a Consortium through which they coordinate the use of their respective facilities; Gallaudet College, Mount Vernon College, and Trinity College are associate members of the Consortium. Students in approved programs leading to degrees in any one of these institutions have the opportunity to select from the combined offerings of all the particular courses which best meet their needs.

Participation is limited to campus degree candidates. The following, however, are excluded: students in Canon Law, Dentistry, Medicine, and Theology. Law students are also excluded from participation, except for candidates for the degree of Master of Laws at George Washington University and Georgetown University.

In special courses involving private instruction (as in music or art) or tutorial study, if a special fee is charged, this fee is not covered by the Consortium agreement and must be paid by the individual student to the institution administering the course.

Students are encouraged to study the announcements of programs of all the participating institutions. See page 211 for more information concerning registration for Consortium courses.

Registration forms and instructions are available from the registrar and in Room 103, Tompkins Hall. Students register and pay tuition at their own institutions for Consortium courses; course fees are payable to the visited institutions.

Center for Academic and Administrative Computing

The Center for Academic and Administrative Computing is located on the third floor of Lisner Hall, 2023 G St., N.W. The computer and other opera-

tional supportive services are located on the first floor of Stuart Hall, 2013 G St., N.W. These facilities normally are available 24 hours a day, seven days a week, to all faculty, staff, and students.

The Center provides computational facilities, conducts seminars, consults with users, and provides operational assistance as required. The Center operates an IBM (OS VS1) central processing unit and a PDP 11 minicomputer which provides a terminal-based text-editing system for students. There is a full range of compilers and application software packages.

Computer programming courses are offered by the School of Government and Business Administration, the Department of Statistics, and the School of Engineering and Applied Science. In addition, many other departments offer courses that utilize the computer as a research adjunct to course work.

Any student of the University may have access to the computer for class-related or individual research. Access is by request and without charge.

The Speech and Hearing Center

The Speech and Hearing Center offers diagnostic and remedial work for children and adults with such communication difficulties as stuttering, lisping, cleft-palate speech, and cerebral-palsied speech; and with voice, articulatory, and hearing problems. Diagnostic and remedial work is also available for persons with nonstandard language usage due to such conditions as hearing loss, brain damage, mental retardation, and environmental factors.

The Reading Center

The Reading Center offers individual diagnostic and corrective services for all levels: primary, elementary, secondary, and adult. In addition, special reading improvement classes are conducted for high school and college students as well as other adults.

A complete diagnosis includes psychological tests; vision, hearing, dominance, and spelling tests; and various types of reading achievement and aptitude tests. Results are interpreted, and a written report is presented in conference with the parents or the individual.

The special reading improvement classes for high school students, college students, and other adults are offered throughout the year at stated intervals. Emphasis is placed on improvement of vocabulary, speed, comprehension, and study skills. Instruction in spelling is also provided as needed.

Fees--Individuals should contact the Center regarding the fee schedule. All fees are payable in advance at the Reading Center, Building C, Suite 429, 2201 G Street, N.W.

Veterans Benefits

The Veterans Counselor's Office, located on the third floor of Rice Hall, 2121 Eye St., N.W., assists those students entitled to educational benefits as veterans or as widows or children of deceased or totally disabled veterans with any problems which may arise concerning their benefits. This Office also processes

certification of enrollment and attendance to the Veterans Administration so that educational allowances will be paid.

When feasible, students entitled to benefits as veterans or dependents of veterans should consult with the veterans counselor prior to submitting application to the Veterans Administration. All such students should obtain the instruction sheet issued by the veterans counselor which sets forth requirements to be fulfilled before certification of enrollment can be made to the Veterans Administration and which includes other information of general interest.

The Veterans Administration is at 941 N. Capitol St., N.E., Washington, D.C. 20421.

ROTC

George Washington University students may enroll in the Army ROTC program offered at Georgetown University, the AFROTC program at the University of Maryland, or the Army ROTC or AFROTC at Howard University. Those interested should contact the ROTC enrollment officer at one of these universities. Credit for such courses may be transferable to George Washington University; prior approval is required by the dean of the school in which the student is enrolled.

Alumni Associations

THE GENERAL ALUMNI ASSOCIATION

The objectives of this Association are to unite the graduates who wish to associate themselves for charitable, educational, literary, and scientific purposes, and to promote the general welfare of the University.

Membership in the Association is conveyed automatically to anyone who has been graduated from any school or division of the University. Anyone who has earned 15 credit hours or the equivalent at the University and whose class has graduated is eligible for membership; in the case of the Division of Continuing Education and Summer Sessions students, however, only the "15 credit hours earned" requirement and not the "graduation of the class" requirement applies. Any persons who are or have been members of the University's Board of Trustees, members of the faculty and administrative staff, as well as anyone else determined to qualify by the Governing Board, is eligible for membership in the Association.

The affairs of the Association are directed by a Governing Board, the majority of whose members represent the constituent alumni of the University's schools and colleges.

The voluntary leadership of the Association works closely with the staff of the Alumni Relations Office in carrying out Association affairs. The Association may be contacted through the Alumni Relations Office.

All alumni are urged to keep the Alumni Relations Office informed of changes of address or occupation and to supply information with regard to their fellow alumni. The Office is located in Alumni House, 714 21st St., N.W., George Washington University, Washington, D.C. 20052.

THE ENGINEER ALUMNI ASSOCIATION OF THE GEORGE WASHINGTON UNIVERSITY, INC.

The Association was organized in 1936 and incorporated in 1963 to coordinate with the General Alumni Association those activities of primary interest to the engineering alumni. The objectives of the Association are to provide the link between the graduates and faculty of the School, to help promote the general welfare of the School of Engineering and Applied Science and of the University, to foster activities of the engineering organizations recognized by the University, and to advance the engineering profession in general.

In 1966 a board of directors, comprised of 15 elected members of the Association and the Engineers' representatives serving on the Governing Board of the General Alumni Association, was established. The membership of the board of directors was expanded in 1969 to include the Director of Alumni Relations and one representative each from the faculty of the School and the student body. Members of the Association are elected each year, prior to the June meeting, to three-year board memberships as listed below:

Term Expiring 1982
Wesley G. Harris
Richard Hu
Mary O. Jones
John P. Storms
Stuart F. Terrett III
James Wong

Term Expiring 1983
Robert Dickey, Jr.
Jacquelyn Eisenberg
Pastor Farinas
David W. Johnson
Harold Sangster

Term Expiring 1984
Frank F. Atwood
Nahid Khozeimeh
Eric S. Mendelsohn
Dudley J. Schwartz
James A. Sinsabaugh

General Alumni Association Representatives
Douglas L. Jones
John R. Manning
Issa Khozeimeh

Student Representative
Mark Eisenberg

Faculty Representative
Galip M. Arkilic

Regional Director
William H. Holt

At the June meeting each year the board elects officers for its operation during the upcoming year. The officers for the year 1981–82 are:

President—Pastor Farinas, M.E.A. 1972; 5 Bethayres Ct., Rockville, Md. 20855
Vice President—Eric S. Mendelsohn, B.S.C.E. 1967; 7728 Warbler Lane, Derwood, Md. 20855
Secretary—Wesley G. Harris, B.S.C.E. 1962; 8732 Higdon Drive, Vienna, Va. 22180
Treasurer—Dudley J. Schwartz, M.S. 1973; 14132 Flint Rock Road, Rockville, Md. 20853

STUDENT LIFE

The Office of the Vice President for Student and Alumni Affairs develops student life services, policies, and procedures to complement the University's formal instruction program. These activities are implemented through the offices of the Cloyd Heck Marvin Center, Counseling Center, Dean of Students, Educational Opportunity Program, Housing, International Students, Student Activities, Student and Alumni Career Services, and Student Health Service.

Student Services

OFFICE OF THE DEAN OF STUDENTS

The Office of the Dean of Students provides counseling and information for students and assists in program development for the Division of Student Affairs. Staff members are well-informed on University policies and the various student services provided on campus, enabling them to provide referrals and answers to many questions concerning general student life. Personal letters of recommendation for students applying to graduate and professional schools can be obtained from this office. The Dean of Students is responsible for the services and programs offered by the Counseling Center, the Educational Opportunity Program, International Student Advising Office, Services for Students with Disabilities, the Student Health Service; and the Student and Alumni Career Services Office.

SERVICES FOR STUDENTS WITH DISABILITIES

The Director of Services for Students with Disabilities works to assure that the special services necessary for handicapped students to participate fully in their academic programs and the extracurricular life of the campus are provided for them through University or community resources.

HOUSING

Complete information concerning the University's residence halls is available from the Director of Housing, George Washington University, Washington, D.C. 20052. Information concerning off-campus housing near the University also may be obtained at this Office.

Admission to the University does not include a room reservation. The student will receive, with his notification of acceptance, University residence hall information, an application for residence hall space or apartment accommodation, and a declaration of intent to attend the University. The application for residence hall space or apartment accommodation must be accompanied by a $200 *nonrefundable deposit*. The housing deposit is credited toward the first semester's room charge or held as a security deposit on an apartment. Rooms and apartments are leased for the academic year, and lease payment must be made in early June for the fall semester.

1982–83 Residence Hall Rates Per Person for Two Semesters*

For Men:

Calhoun Hall	
double room	$1,820
triple room	1,770

For Women:

Strong Hall	
single room	1,970
double room	1,820
triple room	1,770

For Men and Women:

Crawford Hall	
double room	1,820
Everglades Hall (limited to juniors and seniors)—	
apartment for two persons	2,110 or 2,010
Building JJ (limited to sophomores, juniors, and seniors)—	
apartment for 4 to 6 persons	1,890
Francis Scott Key Hall (limited to juniors and seniors)—	
apartment for two persons	2,010
apartment for three persons	2,010 or 1,890
Madison Hall	
double room	1,820
triple room	1,770
Milton Hall (limited to juniors and seniors)—	
apartment for two persons	2,110 or 2,010
apartment for three persons	1,890
Mitchell Hall	
single room	1,970
Munson Hall (limited to juniors and seniors)—	
apartment for two persons	2,110 or 2,010
apartment for three persons	1,890
Thurston Hall	
double room, triple room, room for four	1,820
suite for six	1,710

* Residence Hall prices and allocation subject to change.

Guthridge Apartments

This apartment house is a University owned, commercially operated building within the campus area. It contains efficiency and one-bedroom units, which are rented only to full-time graduate students on an "as available" basis. Referrals to the resident manager of this building are made by the Director of Housing when notice is received of vacancies. Leases are executed with the management company and are on a month-to-month basis.

FOOD SERVICE

Resident freshmen and sophomores are required to choose one of the following three food service plans. The seven-day, 19 meals per week plan, at the rate of $1,550* for the academic year; the any 14 meals per week plan at $1,480* for the academic year; or the any 10 meals per week plan at $1,420* for the academic year. Participation in the food service plans is optional for junior, senior, and graduate students. Food service payment does not cover University intersession or vacation periods. All meal cards admit bearer to dining rooms in Thurston and Mitchell Halls and to the second floor contract dining room in the Cloyd Heck Marvin Center. Meal cards may also be used on a cash equivalency basis in the Marvin Center first-floor cafeteria and Rathskeller.

Students who observe the Jewish dietary laws can write to make arrangements with the George Washington University Housing Office regarding the B'nai B'rith Hillel Foundation Kosher Meal Plan.

EDUCATIONAL OPPORTUNITY PROGRAM

The Educational Opportunity Program is designed to provide selected District of Columbia high school graduates and other qualified District residents with financial and personal support as well as academic assistance to help students pursue undergraduate degree work at George Washington University. The program office is located at 2127 G Street, N.W.

CLOYD HECK MARVIN CENTER

The Cloyd Heck Marvin Center serves as the campus community center, providing services, conveniences, and recreational and social opportunities for students, faculty, staff, alumni, and guests. Its wide range of facilities provides the setting for a variety of programs conducted by the University Program Board; by the departments of drama, dance, and music; and by other student and faculty organizations.

The Center Governing Board, representative of all segments of the University community, plays an important role in the functioning of the Center by working closely with the full-time staff in the development of procedures and policies which provide a framework for the Center's operation.

STUDENT HEALTH SERVICE

The Student Health Service is an outpatient clinic located in the H. B. Burns Memorial Building at 935 22nd St., N.W.

*Food service prices subject to change.

The Health Service is staffed by physicians, nurse practitioners, and physician's assistants who are capable of addressing most of students' medical problems. Visits are cost-free and may be either arranged by appointment or, during certain hours, secured on a walk-in basis. Most routine laboratory tests may be performed in the Health Service lab at cost, many common medications are stocked to fill students' prescriptions, and allergy shots and immunizations are administered by the staff nurse for a minimal charge. A psychiatrist works in the Health Service to assist students with mental health concerns.

For serious emergencies occurring during hours when the Student Health Service is closed, students may go to the Emergency Room of the University Hospital for treatment. This arrangement is for emergency care only, and all fees are the responsibility of the student.

Students must be currently enrolled on campus in the University to receive treatment at the Student Health Service. Students enrolled in the off-campus programs and the Continuing Engineering Education Program are not eligible. Students who so desire may engage physicians and nurses of their own choice, but these students will be responsible for all fees charged. The bills incurred from all services rendered outside of the Student Health Service (for example, X-ray work, laboratory work, and referrals to specialists or other outside physicians) are the responsibility of the student.

Health and Accident Insurance

The University has arranged for and endorsed group health and accident insurance, on an elective basis, for those students who do not have other coverage. Interested students should consult the Student Health Service or the Office of the Dean of Students.

COUNSELING CENTER

The Counseling Center, located at 718 21st St., N.W., works to enable students to overcome obstacles which hamper learning. The Center's services are offered to students and staff, and include resolution of the individual's educational, vocational, or personal conflicts through short-term individual or group counseling, vocational testing, or study skills training; training of graduate students, resident assistants, and paraprofessionals; consulting on mental health topics; and development of new methods and programs to aid student growth, such as counseling through written communication, videotaped counselor skills training, and interpersonal skills workshops.

The Center administers the Miller Analogies Test, admissions testing, and special assessments for business and industry. Through its Office of Community Services, the Counseling Center also provides vocational counseling and educational programs to the greater Washington community.

Students may request a cost-free interview from 9 a.m. to 4:30 p.m., Monday through Thursday, and 1 to 4:30 p.m. on Fridays. If the student decides to continue, a modest fee per appointment will be charged for short-term treatment. If a test battery is called for, an additional $16 materials fee will be charged. However, if financial need is a factor, fee adjustments can be made.

INTERNATIONAL SERVICES OFFICE

Located in the International House at 2129 G St., N.W., the staff of the International Services Office provides advising and counseling in matters of personal and academic concern and visa regulations. This office is also a consultation, information, and resource center for the University's international population.

STUDENT AND ALUMNI CAREER SERVICES OFFICE

The Career Services Office provides career guidance and placement assistance to University students and alumni. Some of the specific services are: full-time and part-time job vacancy lists, career counseling, programs on job-seeking skills, a resource center of literature on occupations and employers, and current information on government employment including testing dates and application forms. Seniors and alumni may also use the Office to establish credential files for application to graduate schools and for employment. The Office is located at Woodhull House, 2033 G St., N.W.

RELIGIOUS LIFE

The University recognizes the contribution that religion makes to the life of its students and encourages them to participate in the various religious organizations of their own choice. Catholic, Jewish, and Protestant bodies sponsor various groups and form a link between the University and the religious community. The advisers of the religious organizations are available for counseling. Religious services and special observances are also provided for the University community as announced.

DAVIS-HODGKINS HOUSE

The Davis-Hodgkins House is the student center of the School of Engineering and Applied Science, providing lounges, reading rooms, and student organization offices. The House, at 2142 G Street, N.W., provides convenient, comfortable facilities for the exchange of ideas and good fellowship.

Student Activities

The offices of the Vice President for Student and Alumni Affairs, the Dean of Students, the Director of the Cloyd Heck Marvin Center, and the Director of Student Activities are responsible for all co-curricular phases of student life.

STUDENT ACTIVITIES OFFICE

The Student Activities Office assists individual students and organizations in program development, campus leadership training, and participation in special projects, both within the University community and the community at large. The Office serves as a clearinghouse for activities information, registers and advises student organizations, and informs the University community of activities and programs through monthly and annual publications. The Student Activities Office is also responsible for coordinating the orientation program for new students, and for planning supplemental development programs for graduate

and undergraduate students. Students who want to participate in the extracurricular phases of University life should acquaint themselves with the facilities and staff of the Student Activities Office.

Additional information about the numerous student organizations and committees is contained in the *Student Handbook*, compiled by and available at the Student Activities Office in the Marvin Center.

STUDENT GOVERNMENT

The George Washington University Student Association is comprised of all full-time and part-time graduate, professional, and undergraduate students who are registered for academic credit on campus. A body of elected and appointed individuals is responsible for representing the interests of students at the University. The Student Association provides various services for students such as an academic evaluation, a student directory, and the Student Advocate Service. Further information can be obtained from the Student Association offices in the Marvin Center.

Student involvement in the governance of the University is also possible through participation in various administrative and Faculty Senate committees, advisory councils of the schools and colleges, selected committees of the Board of Trustees, and specialized bodies such as the Residence Hall Association, the Joint Food Services Board, and the Marvin Center Governing Board. This involvement has helped develop policies and programs beneficial to students and to the total University community.

THE ENGINEERS' COUNCIL

The Engineers' Council is the student governing body for the School of Engineering and Applied Science, composed of elected representatives from each level class and from the graduate student body, from each student organization in the School, and the House Manager of the Davis-Hodgkins House. The purpose of the Council is to provide liaison between the student body of the School and the Faculty, Administration, and Student Government of the University in all matters affecting the general interests and welfare of the student body, the School, or the University. The Council is maintained financially by the Engineers' Council fee paid by each student in the School, and sponsors the Engineers' Mixers and the Engineers' Ball. Council meetings are open to all students in the School.

STUDENT ORGANIZATIONS

Students are encouraged to become involved with existing student organizations or to initiate their own. There are approximately 160 organizations on campus concerning a broad spectrum of interests including: academic, professional, honorary, international, cultural, political interest, service, special interest, sports, hobbies and recreation, religious and meditative, as well as social fraternities and sororities. More complete information about these organizations can be obtained through the Student Activities Office.

The following are of particular interest to students in the School of Engineering and Applied Science.

Honor Societies

Sigma Xi—A national scientific honor society, the purpose of which is to encourage original investigation in pure and applied science. Outstanding graduate students in the sciences are eligible for full membership, and undergraduates who have shown marked ability in research may be elected to associate membership.

Delta Sigma Rho-Tau Kappa Alpha—A national forensic society.

Mortar Board—A national society for juniors and seniors, stressing leadership, scholarship, and service.

Omicron Delta Kappa—A national society emphasizing leadership in extracurricular activities.

Phi Eta Sigma—A national society established to encourage and reward high scholarship and attainment, membership in which is limited to those freshmen who attain a scholastic average of at least 3.50 or the equivalent.

Tau Beta Pi—A national engineering honorary fraternity, the purpose of which is to recognize distinguished scholarship and exemplary character.

Eta Kappa Nu (Theta Iota Chapter)—A national electrical engineering honor society established to recognize scholarship, character, and service.

Omega Rho—A national operations research honor society established to recognize outstanding scholarship, character, and service.

Professional Organizations

American Society of Civil Engineers (Student Chapter).

American Society of Mechanical Engineers (Student Chapter).

Institute of Electrical and Electronic Engineers (Student Chapter).

Theta Tau (Gamma Beta Chapter)—A national professional (engineering) fraternity. Membership by invitation to outstanding students who have completed successfully at least the first year in the School of Engineering and Applied Science.

ATHLETICS, INTRAMURAL SPORTS, AND RECREATION

The Charles E. Smith Center for Physical Education and Athletics offers many facilities for student use, including courts for basketball, volleyball, and badminton; a jogging track; a swimming pool; wrestling, gymnastic, and weight rooms; handball and squash courts; and a sauna and lockers. Based in the Smith Center, the men's and women's athletic departments offer a broad program of intramural and recreational activities designed to accommodate various levels of skill, experience, and interest.

The University is a member of the National Collegiate Athletic Association, the Eastern College Athletic Conference, the Association for Intercollegiate Athletics for Women, and the Eastern Association of Intercollegiate Athletics for Women. Its Varsity teams compete against major universities throughout the Midwest and Eastern Seaboard in such sports as basketball, baseball, soccer, tennis, golf, wrestling, crew, swimming and diving, squash, badminton, volleyball, and gymnastics.

MAJOR PROGRAM EVENTS

Art Exhibits—The work of locally, nationally, and internationally known artists is shown in monthly exhibits in the Dimock Gallery in Lisner Audi-

torium and in the art gallery of the Cloyd Heck Marvin Center. With the cooperation of the Curator of Art, an annual student art exhibit is presented.

Concert Series—The Department of Music presents a series of concerts featuring faculty, guest, and student artists throughout each year.

Dance—The GWU Dance Company presents major concerts, informal studio performances, experimental events, television appearances, and lecture-demonstrations. Students may audition to become company members and have the opportunity to choreograph, perform, and gain experience in the technical aspects of dance productions.

International Programs—The International Student Society presents an annual International Dinner in cooperation with foreign embassies and international restaurants. Other programs include regular forums and speakers on international topics.

Orchestra and Chorus Concert Series—The University Orchestra and Chorus are two facets of the lively arts available to students either as credit courses or as extracurricular activities. The Chorus presents major performances to the University community three or four times a year, including regular winter and spring concerts. The University Orchestra presents several performances annually.

Program Board—The University Program Board, composed chiefly of elected and appointed students, is given primary responsibility and resources for student programming on campus. Through its various committees, and in cooperation with other campus groups, it regularly sponsors films, lectures, concerts, social activities, and special events.

Theater—The University Theater produces four or five major plays and musicals during the year on the proscenium thrust stage in the Dorothy Betts Marvin Theatre or in Lisner Auditorium. Additional works, including original and experimental plays, are produced in a more intimate studio theater. Students have the opportunity to participate in all aspects of theater and may receive credit toward their B.A. or M.F.A. degrees for some of their production work.

THE UNIVERSITY

History and Organization

The George Washington University had its beginning in 1821 as The Columbian College in the District of Columbia. The name of the institution was changed in 1873 to Columbian University and in 1904 to The George Washington University. The debt of the University to George Washington, whose name it bears, is large but intangible.

George Washington, as President and as private citizen, had urgently insisted upon the establishment of a National University in the Federal City. There he hoped that, while being instructed in the arts and sciences, students from all parts of the country would acquire the habits of good citizenship, throwing off local prejudices and gaining at first hand a knowledge of the practice, as well as the theory, of republican government. To further the materialization of his hopes, Washington left a bequest of fifty shares of The Potomac Company "towards the endowment of a University to be established within the limits of the District of Columbia, under the auspices of the General Government, if that government should incline to extend a fostering hand towards it." The Congress never extended "a fostering hand." The Potomac Company passed out of existence, and Washington's bequest became worthless.

Fully conscious of Washington's hopes, but motivated primarily by a great missionary urge and the need for a learned clergy, a group of dedicated ministers and laymen sponsored a movement for the establishment of a college in the District of Columbia. Inspired largely by the zeal and energy of the Reverend Luther Rice, they raised funds for the purchase of a site and petitioned Congress for a charter. After much delay and amendment, Congress granted a charter which was approved by President Monroe on February 9, 1821. To safeguard the College's nonsectarian character it provided "that persons of every religious denomination shall be capable of being elected Trustees; nor shall any person, either as President, Professor, Tutor or pupil, be refused admittance into said College, or denied any of the privileges, immunities, or advantages thereof, for or on account of his sentiments in matters of religion."

During the entire time when the institution was known as Columbian College, its activities were centered on College Hill, a tract of forty-six and a half acres between the present Fourteenth and Fifteenth Streets and extending north from Florida Avenue to somewhat beyond Columbia Road. The Medical School

was located downtown. For the better part of the Columbian University period, the buildings of the University were situated along H Street between Thirteenth and Fifteenth Streets.

During the last half century the University's present plant has been developed in that section of the old First Ward familiarly known as "Foggy Bottom," between Nineteenth and Twenty-fourth Streets, south of Pennsylvania Avenue. The area is not without its reminders of historic interest to the University. President Monroe, who signed the Charter, lived at 2017 Eye Street; the first President of the Board of Trustees, the Reverend Obadiah B. Brown, was for 50 years the pastor of a church at Nineteenth and Eye Streets, and Washington had selected Twenty-third and E Streets as the site of the National University he hoped to see established.

The University as it is now organized consists of Columbia College of Arts and Sciences (undergraduate); the Graduate School of Arts and Sciences; the professional schools, which include the National Law Center and the Schools of Medicine and Health Sciences, Engineering and Applied Science, Education and Human Development, Government and Business Administration, and Public and International Affairs; the Division of Continuing Education and Summer Sessions; and the Division of Experimental Programs.

The George Washington University is privately endowed. It is governed by a Board of Trustees of which the University president is an *ex officio* member.

The University Libraries

The library collections of the University are housed in the Melvin Gelman Library (the general library of the University) and in the libraries of the Institute for Sino-Soviet Studies, the National Law Center, and the School of Medicine and Health Sciences.

These collections contain approximately 1,200,000 volumes, to which are added some 50,000 volumes a year. Endowments supplementing the University appropriation provide books in the fields of American civilization, American literature, foreign service, history, public finance, and the social sciences; and gifts from many sources have enriched the collections. The libraries currently receive about 13,000 serials.

Information concerning the use of the libraries may be obtained at the library service desks.

The library is administered for the curricular, research, and recreational needs and interests of the students. Instruction in the use of the library is given upon request by the reference librarians. The library endeavors to assist students and all members of the University to use the rich library resources of Washington and the unusual opportunities they offer for extensive research. Interlibrary loan arrangements are maintained with other libraries in the city and throughout the United States.

The student has access to the Library of Congress, the Public Library of the District of Columbia and its branches, and many of the special collections of the government departments. Graduate students at George Washington University may, upon application, be issued a Consortium library card which permits direct borrowing from the libraries of the other Consortium Institutions.

The Board of Trustees of the University

Charles E. Phillips, LL.B., LL.M., *Chairman Emeritus*

*Glen A. Wilkinson, B.S., J.D., *Chairman*
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General Information	Private, nonsectarian, coeducational founded 1821
Location	Washington, D.C., bounded by Pennsylvania Avenue and 19th, F, and 24th Streets, N.W.
Number of On-Campus Students	8,995 full-time, 9,822 part-time
Geographical Origin of Students	50 states, District of Columbia, 120 countries
Number of Full-time Faculty	1,102 (87% with doctoral degrees)
Number of Part-time Faculty	530 (includes some of the most distinguished men and women in Washington)
Room and Board	Cost varies from approximately $3,130 to $3,660 for the academic year (see page 230)

Undergraduate majors: Accounting, American Civilization, American Literature, Anthropology, Applied Mathematics, Applied Statistics, Art History, Biology, Botany, Business Administration, Cartography, Chemistry, Chinese Language and Literature, Civil Engineering, Classical Archeology and Anthropology, Classical Archeology and Classics, Classical Humanities, Computer Science, Dramatic Art, Early Modern European Studies, East Asian Studies (China or Japan), Economics, Electrical Engineering, Elementary Education, English Literature, Environmental Studies, Fine Arts, French Language and Literature, Geodesy, Geography, Geology, Germanic Languages and Literatures, History, Human Kinetics and Leisure Studies, International Affairs, Journalism, Judaic Studies, Latin American Studies, Liberal Arts, Mathematical Statistics, Mathematics, Mechanical Engineering, Medical Technology, Middle Eastern Studies, Middle School Education, Music, Nursing Anesthesia, Nurse Practitioner Program, Oceanography, Operations Research and Computational Science, Philosophy, Physician's Assistant Program, Physics, Political Science, Premedicine, Psychology, Public Affairs, Radio-Television, Radiologic Sciences and Administration, Religion, Russian Language and Literature, Russian Literature and Culture —in Translation, Secondary Education, Sociology, Spanish American Literature, Spanish Language and Literature, Special Education, Speech Communication, Speech Pathology and Audiology, Urban Affairs, Zoology.

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THE GEORGE WASHINGTON UNIVERSITY

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SCHOOL OF MEDICINE AND HEALTH SCIENCES: Associate in Science (A.S.), Bachelor of Science (B.S.), Bachelor of Science in Health Science (B.S. in H.Sc.), and Doctor of Medicine (M.D.)

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SCHOOL OF ENGINEERING AND APPLIED SCIENCE: Bachelor of Science (Civil Engineering) (B.S. [C.E.]), Bachelor of Science (Electrical Engineering) (B.S. [E.E.]), Bachelor of Science (Mechanical Engineering) (B.S. [M.E.]), Bachelor of Science (Operations Research and Computational Science) (B.S. [O.R.& C.S.]), Master of Engineering Administration (M.E.A.), Master of Science (M.S.), Doctor of Science (D.Sc.), Engineer (Engr.), and Applied Scientist (App.Sc.)

SCHOOL OF EDUCATION AND HUMAN DEVELOPMENT: Bachelor of Arts in Education and Human Development (B.A. in Ed.&H.D.), Bachelor of Science in Human Kinetics and Leisure Studies (B.S. in H.K.L.S.), Master of Arts in Education and Human Development (M.A. in Ed.&H.D.), Master of Arts in Teaching (M.A.T.), Education Specialist (Ed.S.), and Doctor of Education (Ed.D.)

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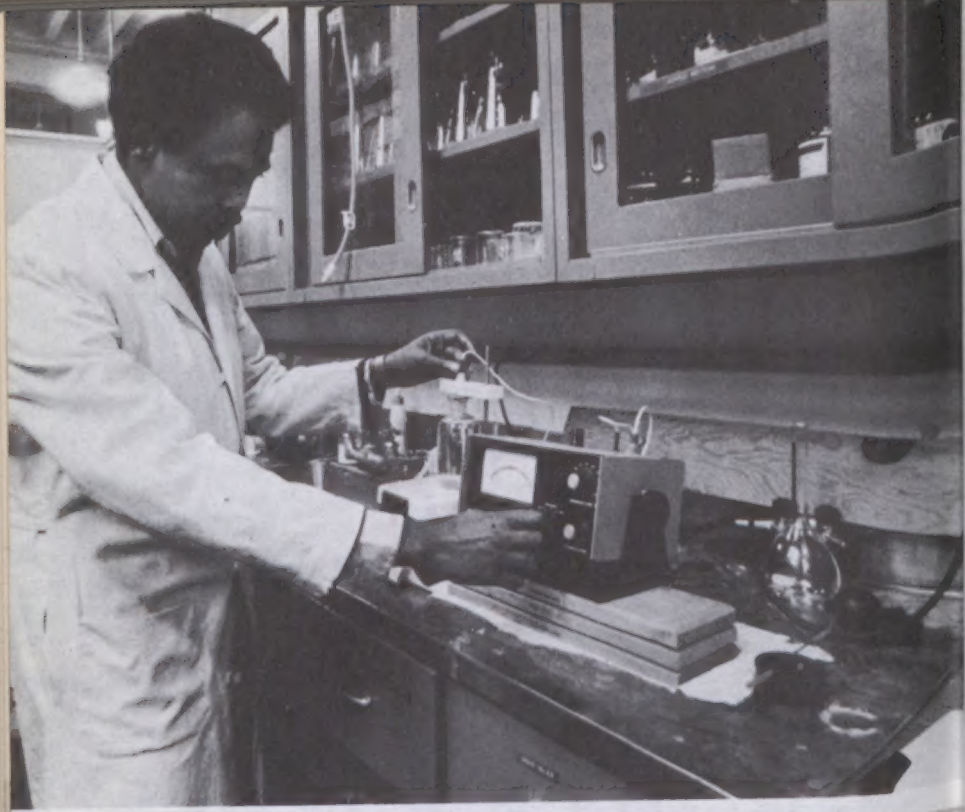
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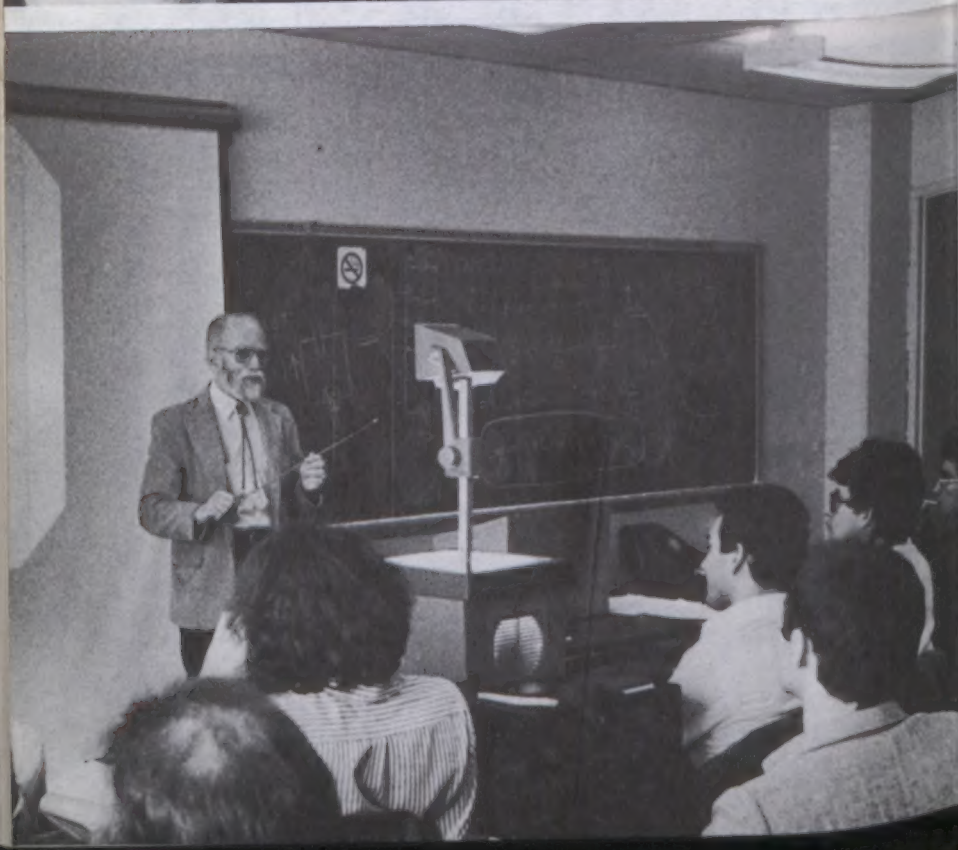

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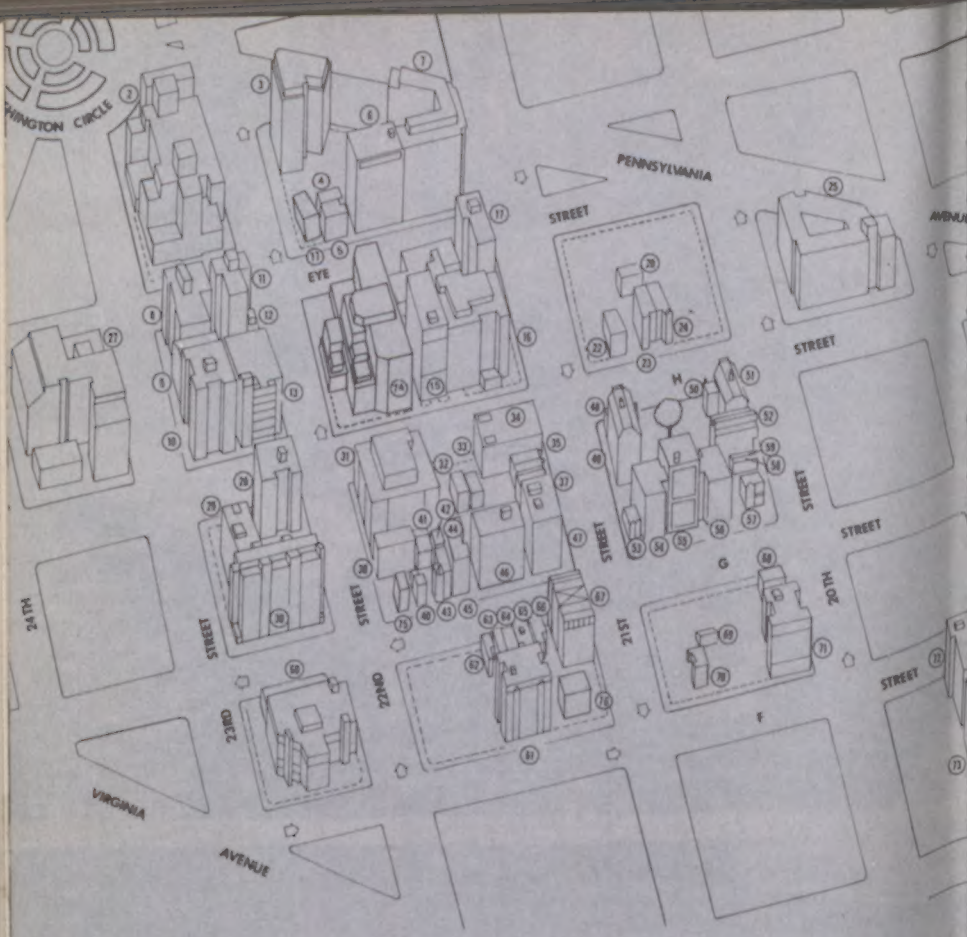






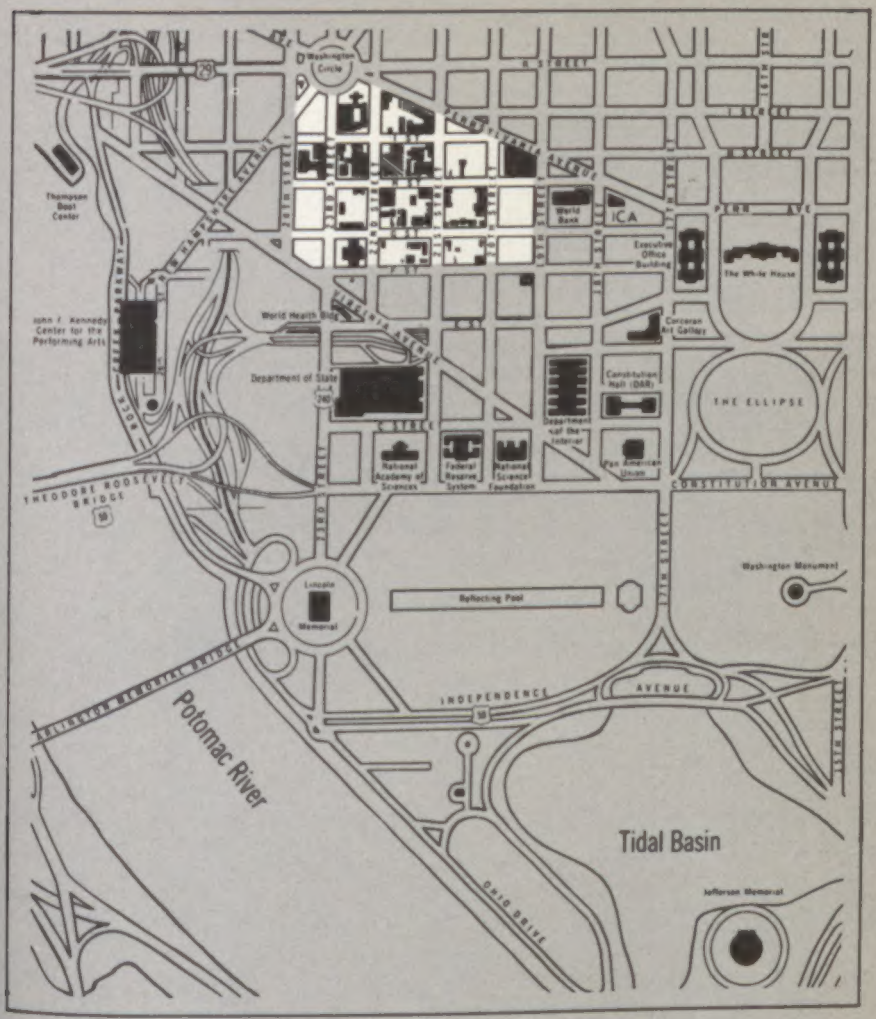






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Bacon Hall, 2000 H St.	50
Bell Hall, 2029 G St.	54
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